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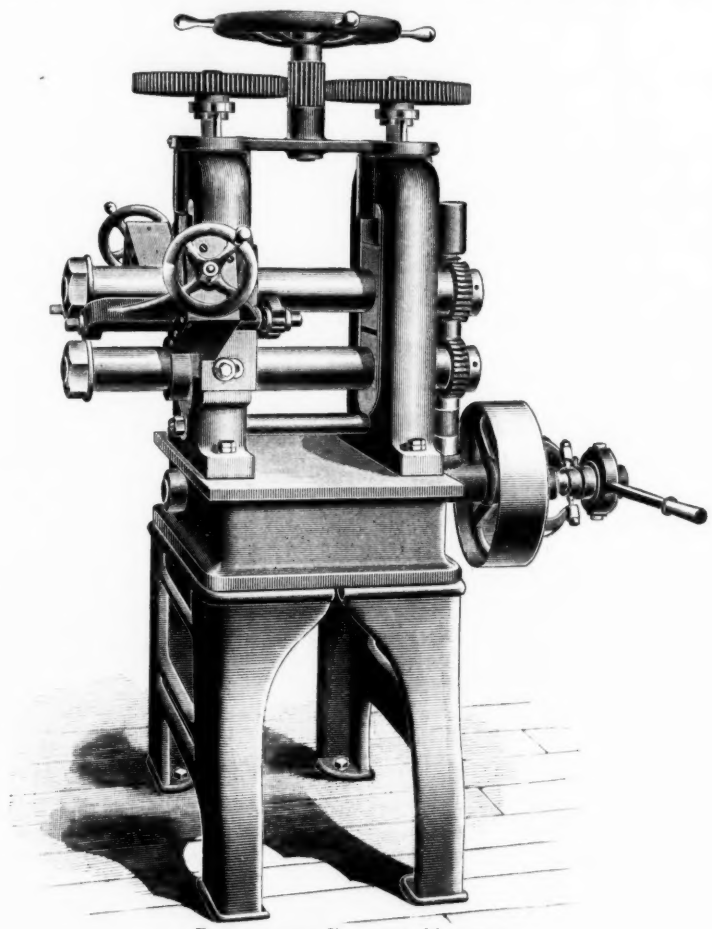
Bicycle-rim Rolling Machine.

The accompanying engraving illustrates a new machine which has been designed for rolling bicycle wheel guards and tires, or rims. As the engraving shows, the machine is neatly and substantially designed, and is provided with every adjustment needed for this class of work. The spindles are of hammered steel, and are adapted to take either a single roll, or three rolls, each 6″ diameter 2″ thick. The worms by which they are driven are of hardened steel engaging with worm-wheels of copper and tin composition, the proportion for the gearing being 32 to 1, so that ample driving power is secured by a narrow and light belt.

A friction clutch at the right of the machine gives complete control of the movement of the rolls, and the upper or guide roll is provided with vertical adjustment by the hand-wheel at the top of the machine, angular adjustment by the smaller hand-wheels at either side, or endwise adjustment by the collar screw shown. The machine weighs 1,950 pounds, and is manufactured by Blake & Johnson, Waterbury, Conn.



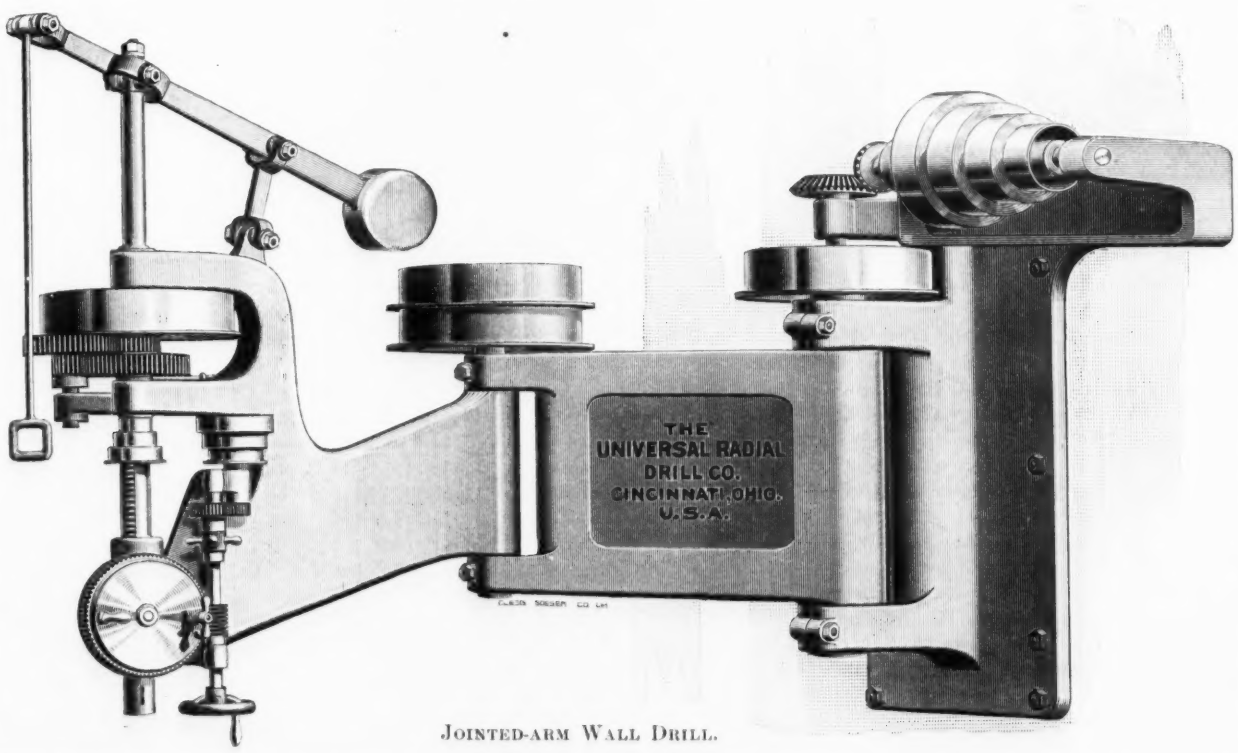
BICYCLE-RIM ROLLING MACHINE.

Jointed-arm Wall Drill.

We illustrate herewith a drill press which has been designed especially for boiler makers, plate workers, bridge and girder shops, etc.

The total distance from the first pivot to the spindle is 72″ and to the wall or post 87″. The joint in the arm enables the spindle to be moved in any desired direction by simply pulling or pushing upon it, and the proportions are such that it is amply rigid for the work it is intended to do.

The machine is built with hand lever feed for reaming and countersinking, with worm and hand-wheel for drilling and boring (in which form it will cut a 4″ hole in steel plate with a two-lipped cutter), or with the power-feed and back gears as shown, in which form it will cut a 6″ hole in steel plate. The machine is built by the Universal Radial Drill Co., Cincinnati, O.



JOINTED-ARM WALL DRILL.

At a recent meeting of the Amsterdam Academy of Sciences, Mr. Behrens dealt with the microscopic structure of alloys. Crystallization is a common phenomenon in metals. The least crystalline are pure Al, Cu, Ni, when cast without overheating. Rapid cooling has no other effect than to make the crystals of smaller size. Pure Ag does show always crystallization, if properly etched. In alloys crystallization is more easy and perfect than in unalloyed metals. When 1 gr. of Cu, alloyed with 2 mgr. Ag, is melted and slowly cooled, it will be found checkered by minute threads of an alloy rich in silver. All types of structure found in crystalline rocks can be reproduced in alloys. The most common is rectangular wickerwork, less common are isolated clusters of crystals (alloys with few crystals of high melting point, as Zn + 10 per cent. Pt, Cu + 10 per cent. Co.) Mechanical stress does not destroy the crystalline structure.

A fibrous or lamellar structure is set up, corresponding with planes of sliding or shearing in inter-crystalline matter, and under heavy stresses partly due to flattening and stretching of crystals. By annealing, alloys of Cu with Ni can be made to crystallize even as soft iron, thereby becoming even brittle.

In one of the largest cities in the State of New Jersey, the Knights of Labor have addressed a letter to the mayor, who was recently elected by a popular uprising and against politics, advising him that they will stand by him in all honest reform, and specifically against the action of some "boards" that are named. It is a good sign.

Inspection.

BY ALBERT D. PENTZ.

The secret of superintendence is the secret of inspection, which secret is sound judgment. For, if an inspector should condemn and reject every imperfect piece, he would be no better inspector than he who should accept all things without any examination whatever. A machine could be designed to inspect for perfection, and an inspector who rejects nothing is a superfluity that burdens the pay-roll, and who adds no endorsement of any value to the quality of the output. Fault-finding is not inspection. No manufactory of any kind, anywhere, produces work that is able to stand a dead open and shut inspection; and while such perfection is perfectly attainable at a greatly enhanced cost, it is found, in practical, paying, commercial machinery building, that buyers prefer that which is reasonably perfect, at a reasonable cost, to that which is actually correct, at an extravagant price. The judgment to determine just what degree of workmanship can be taken and used, so that a standard of excellence may be accepted and maintained, which standard will be attractive to buyers at remunerative prices, and demoralizing to competitors, is a rare endowment, and it is of more real value to a manufactory in the long run than any other factor whatever. A brilliant salesman with a showy and reasonably priced line of goods can place a great many orders for them in his first trip out, but if the work is not good, so that in practical use it compares equally with, or is better than similar lines of other makes, the hopes raised by this initial success will be dashed down by the complaints received, and the impossibility to get further orders, and the quality of its workmanship will either of necessity be raised—in which case there is a hill to be climbed to get back again to the first position, which climbing will entail more work than originally was required to produce the first installment of the goods—or the line will be a failure.

The prime requisite of a good inspector is that he must understand himself, in so far that he shall have confidence in his own judgment, and that that confidence shall be endorsed by the results of his past experience. This quality must be natural, and can be neither acquired nor imitated, but without it an inspector is of small value. For instance: In a factory on a certain time there were two inspectors,

each with undefined powers, one of whom passed three thousand dollars worth of work which had a defect of appearance, but which was as good in workmanship as the standards required. The other inspector, however, demurred, appealed to the management, was sustained, and the work was rejected. The first inspector, being confident that a mistake was being made, succeeded in saving the work from destruction, and had it stored away in a vacant room; and two years afterward, when the particular device to which this condemned work belonged was better understood, he had it brought out and the rejection reconsidered, and there was not one complaint from a customer on the point in question. In this connection an inspector will sometimes make mistakes and even errors of consequence; but he must be a man who, when he believes he is right, dares to act honestly and without stubbornness or conceit as far as his powers permit him.

The second requisite in an inspector is that he must thoroughly understand his work. He must be familiar not alone with the limits and qualities of the parts he overlooks, but their offices in the assembled whole device, and the operation of the machine in practice as well. If an inspector does not know the exact uses to which a piece is to be put, or what is to be expected of it, he can have no data to assist his judgment in deviations from exactitude. The reader is an inspector, for every person overlooks some one's work, his own in particular. Suppose he is required to decide whether a lot of gears, which are each one-hundredth of an inch too large or too small in diameter, should pass, or whether another lot shall be made of the correct size to replace them. If he knows nothing of the environment of those gears when they shall be in place, he cannot decide otherwise than reject them; for, if he must call in the services of another person who does know, he exposes his lack of knowledge, and shows that it takes two men to be one inspector. Many chief inspectors, however, in large concerns, advocate cheap subordinates, and in getting such they often get those who are not naturally qualified for such work, and who have neither the knowledge to make them proficient and skillful, nor the practice to have familiarized them with the objects to be accomplished by the work they inspect. In such cases the chief inspector is kept very busy in doing much necessary work deciding that the gears above mentioned are spoiled because the distance between centers on the machine they belong to are exact, and the gears must run free and not shake; or that they are acceptable because they are applied to adjustable elements. Now, care in selecting inspectors with the best natural qualifications, and a little time allowed them to become familiar with the uses to which the work they handle is to be put, would pay well if the chief should think of doing it. In fact, if a full working machine be accessible to each inspector it will be found of great assistance. Some years ago the chief inspector of a great factory, as a preliminary to more thorough reforms, made certain changes in the methods of inspecting, which resulted in a saving of more than one-half in the cost of that operation. Before the changes were made each department had a corps of men who inspected in detail the work it finished, or did operations upon; these department inspectors were in the pay of the contractors in charge of the departments, and accountable to them alone. Then the work accepted by the department inspectors was sent to the stock department, and there it was reinspected in detail by other men accountable to the factory management, and working under the instruction of the chief inspector.

The change made was that the chief inspector assumed charge of the inspection in departments, taking a choice from both gangs of men in each case. One of the surprises of this change was that the departments were continually rejecting and destroying work that would have been acceptable had it been sent to the stock department, and thousands of dollars of good work was thus destroyed each year. So much for the evil effects of an antagonistic spirit between an aristocratic "company" department, which accepted a piece haughtily, or rejected it insolently, explaining nothing, and a crowd of department inspectors who got every piece through that they thought would pass, and doctored a piece to improve it if it was slightly lame.

This change at once made order in the whole system. The inspectors were placed just where the operations were made, and in some cases a job was rearranged to group it closer together and about the inspector, so that the man who overlooked a finished part could occasionally inspect an operation to determine whether the tools were correctly doing their work in each operation.

There, of course, was some friction in the outset; for the workmen looked on the inspection of operations as an unnecessary espionage, until they found that they gained

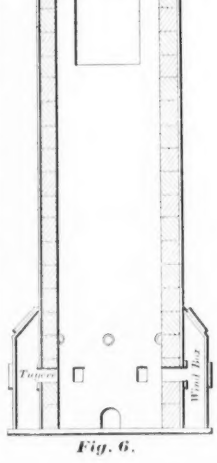


Fig. 6.

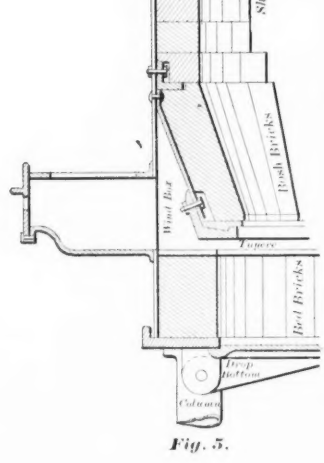


Fig. 5.

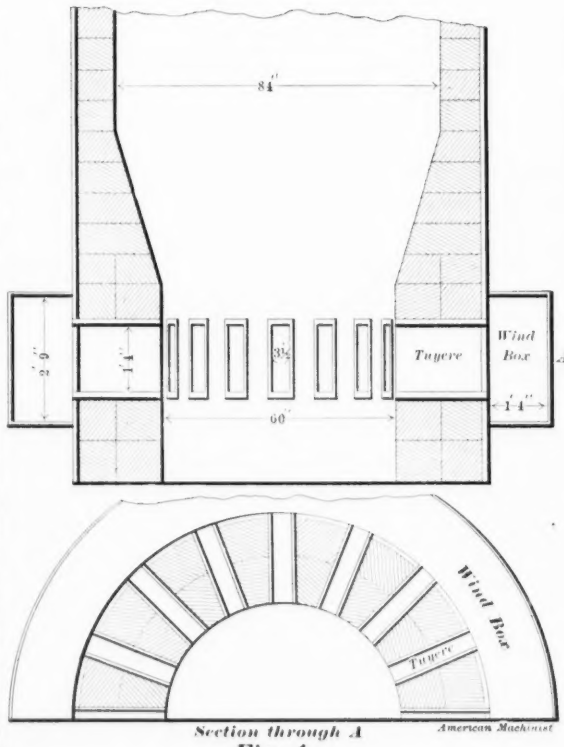


Fig. 4.

MELTING CAST IRON.

more by the prevention of bad work than they lost in time by the interference. They soon found that there was another element dividing the responsibility with them, and that if the legitimate inspector was satisfied with the operations as they were made, he would probably be satisfied with the finished pieces. Gradually the true spirit of manufacture thus became prevalent: That the interests of the men who do the work are identical with the concern that employs them to do it. The great company, it was found, did not want to reject work any more than the humble workman who formed it. The experiences of some men made this great truth a hard one to master, but after a time it was found to be a fact, and then all opposition ceased. It was an edifying sight to see a workman and an inspector together getting a machine in tune, so that it produced a satisfactory operation, both with identical interests, and to get as great results as possible, with the least effort on the whole; for, if the inspector got that operation satisfactory, he would have confidence and less labor in the inspection of that much of the finished piece, and the workman, if he was sure the inspector was satisfied, would progress in confidence, and do more good work than he would if he should be in doubt.

Every day that this system was tried (it is yet in force) new benefits were found, and new savings. The room occupied in the stock department by the inspectors was available for goods. It took one set of gauges less, and consequently fewer gauge makers. It saved in porterage and all other kinds of transportation. It produced harmony between the contractors and the company, for the subject matter of all disagreement was removed. It lessened the pay-roll, for, while the inspectors were under the chief inspector's instructions, retention and selection, they were paid by the contractors.

It may be that this method of inspection may save in other factories.

Melting Cast-iron in Cupolas.

BY S. BOLLAND.

II.

DEPTH OF BOTTOM OF CUPOLA.

Depth of bottom is the distance from the sand bed, after it has been formed at the bottom of the cupola, up to the underside of the tuyeres.

It will be seen, in the table (issue June 30), that all the amounts for fuel are based upon a bottom of 10 inches deep, and any departure from this depth must be met by a corresponding change in the quantity of fuel used on the bed; more in proportion as the depth is increased, and less when it is made shallower.

AMOUNT OF FUEL REQUIRED ON THE BED.

The column, "Amount of Fuel required on Bed, in Pounds," will, I hope be found serviceable; it is based on the supposition that the cupola is a straight one all through, and, as before stated, that the bottom is 10 inches deep. If the bottom be more, as in those of the Colliau type, then additional fuel will be needed.

The amounts being given in pounds, answers for both coal and coke, for, should coal be used, it would reach about 15 inches above the tuyeres; the same weight of coke would bring it up to about 22 inches above the tuyeres, which is a reliable amount to stock with.

FIRST CHARGE OF IRON.

The amounts given in this column of the table are safe figures to work upon in every instance, yet it will always be in order, after proving the ability of the bed to carry the load quoted, to make a slow and gradual increase of the load until it is fully demonstrated just how much burden the bed will carry; for, as before stated, these figures represent the safe load under ordinary conditions as to fuel and blast, in a common cupola, and not what may be accomplished when the most elegant practice is essayed.

SUCCEEDING CHARGES OF FUEL AND IRON.

By consulting the columns relating to succeeding charges of fuel and iron, it will be seen that the highest proportions are not favored, for the simple reason that successful melting with any greater proportion of iron to fuel is not the rule, but, rather, the exception.

Whenever we see that iron has been melted in prime condition in the proportion of 12 pounds of iron to one of fuel, we may reasonably expect that the talent, material and cupola have all been up to the highest degree of excellence.

DIAMETER OF MAIN BLAST PIPE.

The table gives the diameters of main blast pipes for all cupolas from 24 to 84 inches diameter.

No part of the foundry economy has been more neglected than this; go where you will, there seems to have been blundering in this particular; especially is this the case in some old firms, which have made additions to their molding capacity from time to time, necessitating the erection of other cupolas, which have been connected to the old conducting pipe, no matter whether it was adequate to the task of furnishing sufficient blast or not. This is not wise, as the loss by friction in pipes that are too small causes a greater demand on the engine and blower, which, being pushed to their extreme limit, in order, if possible, to maintain a full head of blast, causes a loss from undue wear and tear, which would in a very short time pay the expense of a new and larger set of pipes.

But this is not all; the increased capacity of the pipes in such a case is absolutely necessary, in order to supply the exact quantity of air for perfect combustion, without which we must look in vain for a regular supply of soft fluid iron; this latter want alone ought to be, if properly understood, a sufficient incentive to make us look well after the main blast pipe.

The sizes given opposite each cupola are of sufficient area for all lengths up to 100 feet.

TUYERES FOR CUPOLA.

It will be seen that two columns are devoted to the number and sizes of tuyeres requisite for the successful working of each cupola; one gives the number of pipes 6 inches diameter, and the other gives the number and dimensions of rectangular tuyeres which are their equivalent in area.

From these two columns any other arrangement or disposition of tuyeres may be made, which shall answer in their totality to the areas given in the table.

By referring to the column, "Number of Tuyeres 6 inches diameter," etc., it will be found that the 60-inch cupola would require a little over 13½ such tuyeres to furnish a sufficient volume of blast to insure successful melting, and opposite to this, in the column for Flat Tuyeres, will be found that 8 flat tuyeres 16½ inches by 3 inches would be their equivalent, and by the same method it is seen that the 24-inch cupola would need one and a half round tuyeres 6 inches diameter, or two flat ones 10½ inches by 2 inches.

When cupolas exceed 60 inches in diameter, the increase should begin somewhere above the tuyeres, after the manner shown at Fig. 4, which represents the lower portion of a cupola 84 inches diameter above the tuyeres, and 60 inches diameter below. This method is absolutely necessary in all common cupolas above 60 inch, because it is not possible to force the blast to the middle of the stock, effectively, at any greater diameter.

On no consideration must the tuyere area be reduced; this is, to all intents and purposes, an 84-inch cupola, and must, as is seen in the table, have tuyere area equal to 31 pipes 6 inches diameter, or 16 flat tuyeres 16 inches by 13½ inches.

If it is found that the given number of flat tuyeres exceed in circumference that of the diminished part of the cupola, they can be shortened, allowing the decreased length to be added to the depth, or they may be built in on end, as seen in Fig. 4; by so doing, we arrive at a modified form of the famous Blakeney cupola.

Various methods have been adopted to overcome the difficulty of reaching the middle of the furnace with a sufficient volume of blast to insure perfect combustion; amongst

others, in particular, we notice the Makenzie cupola, which, they claim, differs from all others in having a continuous tuyere, which allows the blast to enter the fuel at all points. This construction, they further claim, brings the blast to the center of the furnace with the least possible resistance and the smallest amount of power. The method of introducing the blast into the Makenzie cupola is illustrated at Fig. 5.

Another highly important point in this connection is to arrange the tuyeres in such a manner as will concentrate the fire at the melting point into the smallest possible compass, so that the metal in fusion will have less space to traverse while exposed to the oxidizing influence of the blast.

To accomplish this, recourse has been had to the placing of additional rows of tuyeres in some instances—the "Stewart rapid cupola" having three rows, and notably, the "Colliau cupola furnace," which has two rows of tuyeres.

The patentees of the Colliau claim that their records show the most economy in fuel and iron, the greatest rapidity in fusion, and the largest amount of iron melted in a given time and size, as well as the greatest quantity of iron melted in a cupola without clogging.

It will be seen by consulting Fig. 6, which is a representation of a Colliau cupola, that it is in all respects, except the tuyeres, a common cupola; therefore, whatever its superiority over others, common ones may be, all the credit is due to the ingenious disposition of the tuyeres.

BLAST PRESSURE

Accurate experiments made by experts in this branch of science prove, beyond doubt, that about 30,000 cubic feet of air are consumed in melting a ton of iron, which, if reduced to a solid, would weigh about 2,400 pounds, or more than both iron and fuel. In reference to this important subject, an authority says: "When the proper quantity of air is supplied the combustion of the fuel is perfect, and carbonic acid gas is the result. When the supply of air is insufficient, the combustion is imperfect, and carbonic oxide gas is the result. The amount of heat evolved in these two cases is as fifteen to four and a half (15 : 4½), showing a loss of over two thirds of the heat by imperfect combustion. Though the difference between perfect and imperfect combustion is so astonishing, it is seldom taken into account by foundrymen, and most of them are unconsciously submitting to a great loss, which can be easily remedied."

It is not always true that we obtain the most rapid melting when we are forcing into the cupola the largest quantity of air. Some time is required, says the authority previously quoted, to elevate the temperature of the air supplied to the point that it will enter into combustion. If more air than this is supplied, it rapidly absorbs heat, reduces the temperature, and retards combustion, and the fire in the cupola may be extinguished with too much blast, as the flame of the lamp is blown out with the breath.

When all these conditions are well understood by the student in cupola practice, he will then realize how important it is that the requisite amount of pressure, and no more, be maintained during the whole process of melting.

In the table will be found a column, Blast Pressure required in Ounces, which gives the amount of pressure required for each sized cupola.

BLOWERS AND ENGINES.

The blowers chosen as standards for this table are the Root and Sturtevant; should any other be used it is important that their capacity be measured, so that any difference may be noted, and due allowance made.

Should it be required to know which size of Root blower would be most suitable for supplying blast to a 42-inch cupola, it will be found to be a No. 5, opposite to which number is 17½ horse-power, being the power of engine needed for a No. 5 Root blower; and by the same method, if for the same sized cupola a Sturtevant blower was desired, the number of blower will be a No. 5, but the engine is 5½ horse-power. Be sure that the engine is of sufficient power to insure a full or maximum blast, and, if possible, have it free from any other machinery.

TOTAL MELTING CAPACITY OF CUPOLAS.

The figures given in the column, Total Melting Capacity of Cupolas, in Pounds, are not meant as absolute (to do that would be impossible, the melting capacity of any cupola is influenced, for good or bad, by the amount of intelligence which is brought to bear upon its management); they are approximate under ordinary circumstances, and will be of assistance in selecting a suitable cupola for the work in hand.

SLAG IN CUPOLAS.

A certain amount of slag is necessary to protect the molten iron which has fallen to the bottom from the action of the blast; if it was not there the iron would suffer from decarbonization, and would consequently be less fluid.

When slag from any cause forms in too great abundance, it should be led away by inserting a hole a little below the tuyeres, through which it will find its way as the iron rises in the bottom.

In the event of clean iron and fuel, slag seldom forms to any appreciable extent in small heats; this renders any preparation for its withdrawal unnecessary, but when the cupola is to be taxed to its utmost capacity it is then incumbent on the melter to flux the charges all through the heat, carrying it away in the manner directed.

The best flux for this purpose is the chips from a white marble yard; this is a much purer limestone than any other of the carbonates, and requires less melting. About 6 pounds to the ton of iron will give good results when all is clean, as it suffices to keep the cupola open during a long heat without flooding at the tap hole, at the same time it softens the cinder, and makes it much easier to chip out afterwards.

When fuel is bad, or iron is dirty, or both together, it becomes imperative that the slag be kept running all the time, otherwise the cupola will bung up gradually, and become useless before half its work is completed.

FUEL FOR CUPOLAS.

Without doubt, the best fuel for melting iron is coke, simply because it requires less blast, makes hotter iron, and melts faster than coal. When coal must be used, care should be exercised in its selection. All anthracites which are bright, black, hard, and free from slate, will melt iron admirably. The size of the coal used affects the melting to an appreciable extent, and, for the best results, small cupolas should be charged with the size called "egg," a still larger grade for medium sized cupolas, and what is called lump will answer for all large cupolas when care is taken to pack it carefully on the charges.

LINING AND REPAIRING CUPOLAS.

For many years I have demonstrated the fact that the best man to line or build up a cupola is an intelligent cupola man, who will see to it that every brick is rubbed well down on its fellow; also that it fits the shell as close as it is possible to make it.

For best results the mortar should be as near as possible of the same nature as the bricks. When requested to do so, the dealers can always supply the right article. Any attempt to make this mortar from the clays and sands in ordinary use should be scouted, as the bricks soon become loose if inferior clay is used in their setting, and this brings about an early collapse of the whole structure.

Too little attention is usually paid to the nature of the materials supplied the melter for repairs; hence a new lined cupola, which ought to last from one to two years, is used up in half the time, and sometimes less. If the best silicious sand and the most refractory fire clay was used for this purpose, there would be a great saving effected in the course of a year.

A good melter will note the form of the inside of his cupola when it has been newly lined, and endeavor by careful mending, every morning to maintain the original shape. If he finds it is wearing fast at the melting part, he will not endeavor to prevent that by pressing into the cavity large quantities of wet clay, for he knows that by so doing it is more than likely that the whole patch would fall away as soon as the great heat to which it is subjected comes upon it.

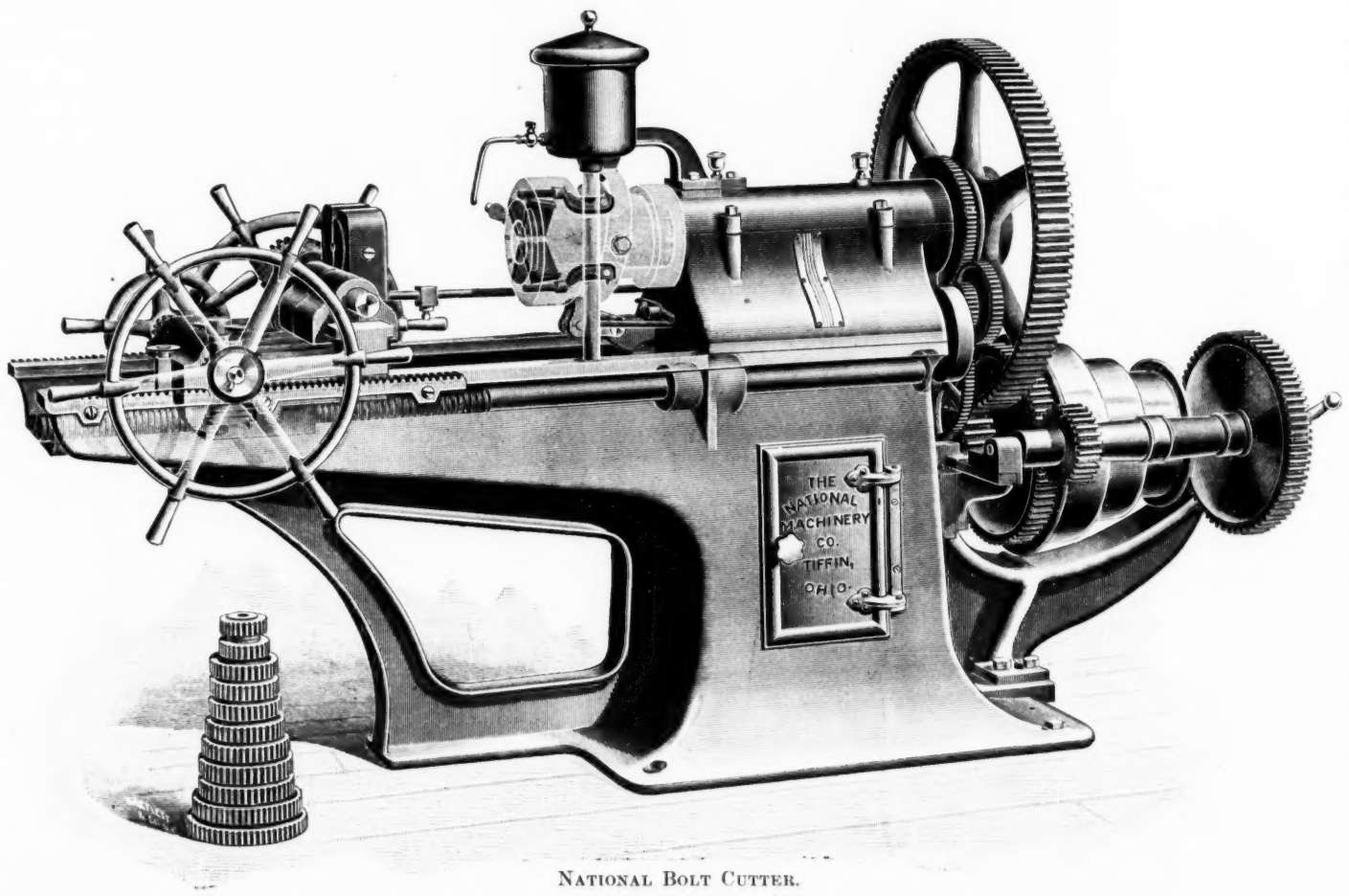
If it is found that the bricks are wearing fast at that part, the right course to pursue is to rub well on a thin coat of daubing each day, until it is thought advisable to chip out a course or two at the bad spot, and make good with new bricks.

CHARGING THE CUPOLA.

As the table serves the purpose of explaining, approximately, the amounts of fuel and iron to be charged on the various sized cupolas, it only remains to be said that, in order to obtain the best results at the cupola, choice must be made out of the most intelligent of the unskilled help in the foundry, from which to train a skillful melter.

Let him be taught the importance of strict observation, taking care to duly mark every change in the operations of melting, and make note of the results; and whilst it will always be his pleasure to do as his foreman instructs, he must cultivate a spirit of self-reliance, which every day's experience will serve to strengthen and solidify.

The pleasure of having a melter who can be trusted to do as he is instructed, and who can also be depended upon for the intelligent performance of all the details connected with the successful management of cupolas, is known to no one more than to the writer of this article.



NATIONAL BOLT CUTTER.

National Bolt Cutter with Lead Screw.

We present with this an illustration of a "National" bolt cutter fitted with a lead screw for feeding the carriage at the proper rate for the bolt to be cut, change gears being provided for the screw, the same as for the lead screw of a lathe.

Where square or bastard threads are cut on a bolt cutter, it is found very difficult, if not impossible, to get satisfactory results without a lead screw, owing to the drag of the die, and the tendency is to increase the size of screws cut on bolt cutters, and to cut screws upon them formerly considered fit only for the lathe. A lead screw makes this practicable, and some remarkable jobs of thread cutting are now done in this way.

The machine is provided with all the latest improvements in the way of automatic and hand-opening dies, pump, etc., and with the "National Case Die." It is made by the National Machinery Co., Tiffin, Ohio.

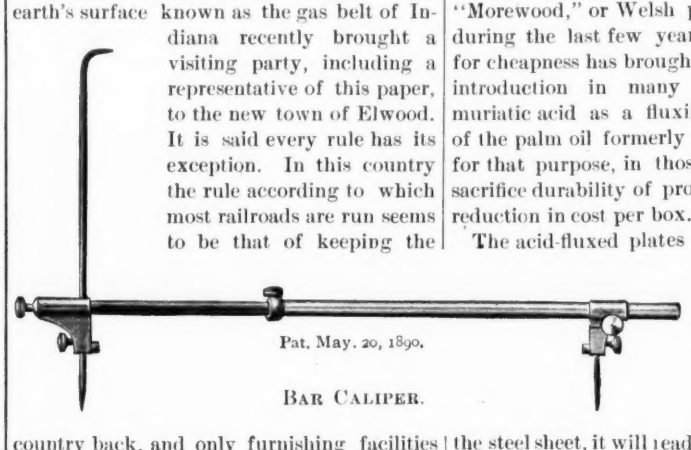
It appears that a "spy gallery" has been arranged at the New York post-office, by means of which the operations of the clerks can be watched. The next improvement should be a gallery through which to note the operation of the spies, and so on *ad infinitum*.

Bar Caliper and Tram.

We present herewith an illustration of a new tool for machinists use, intended for scribing circles of large diameter, or for calipering up to 20″.

The tool consists essentially of a steel bar, in which a V groove is formed on one side, running its entire length, a hard brass tube which fits over this bar having a corresponding V groove rolled in it, so that the two engage. At the inner end of the tube is a collar which is sweated on and provided with a clamping screw, by which the tube is clamped in any desired position on the bar. To the tube is fitted a head, which carries a scriber and one hardened steel caliper face, while to the extreme end of the bar is secured another head which carries the corresponding caliper face, and a scriber which is adjustable vertically to suit the work; as, for instance, when the surface upon which the arc or circle is to be scribed is at a different level from that on which the center must rest. This last mentioned head is a close sliding fit on the bar, but can be moved by the screw at the end for fine adjustment. There is also a screw, not shown in the engraving, by which additional friction may be had when desired, and there is never any need to tighten a screw after the adjustment is completed.

When closed up the tool is 12″ long, and it can be used in this way, yet is capable of describing circles 40″ diameter, or calipering nearly up to 20″. Thus, while it is adapted to work of considerable size, it yet occupies but little room in the tool chest. The tool is manufactured by Fred. A. Welles, 419 Sycamore street, Milwaukee, Wis.



Pat. May. 20, 1890.

BAR CALIPER.

New Globe Valve Disks.

The cuts shown herewith, Figs. 1, 2, 3 and 4, show the different style valve disks as lately brought out, and now used in connection with the Blessing removable seat and disk globe, angle, and radiator valves; Fig. 1 showing the beveled disk, Fig. 2 the flat face for extra high pressure, and Figs. 3 and 4 a holder to use any of the elastic composition disks, such as the Jenkins material.

The valve disks can be quickly removed from or placed on the stems, and the small amount of metal required to make the seats and disks permits the use of the very best material at a reasonable cost. These being the only parts liable to wear out, the valve will last as long as one made wholly of the superior and costly metal.

To renew the disks close the slotted ends of the two round-headed pins, and take them out. The disks can then be easily removed and repaired. To replace and lock the disks on the stems insert the pins in their holes, and open the slot in the ends, as shown in Fig. 4. They are manufactured by the Albany Steam Trap Co., Albany, N. Y.

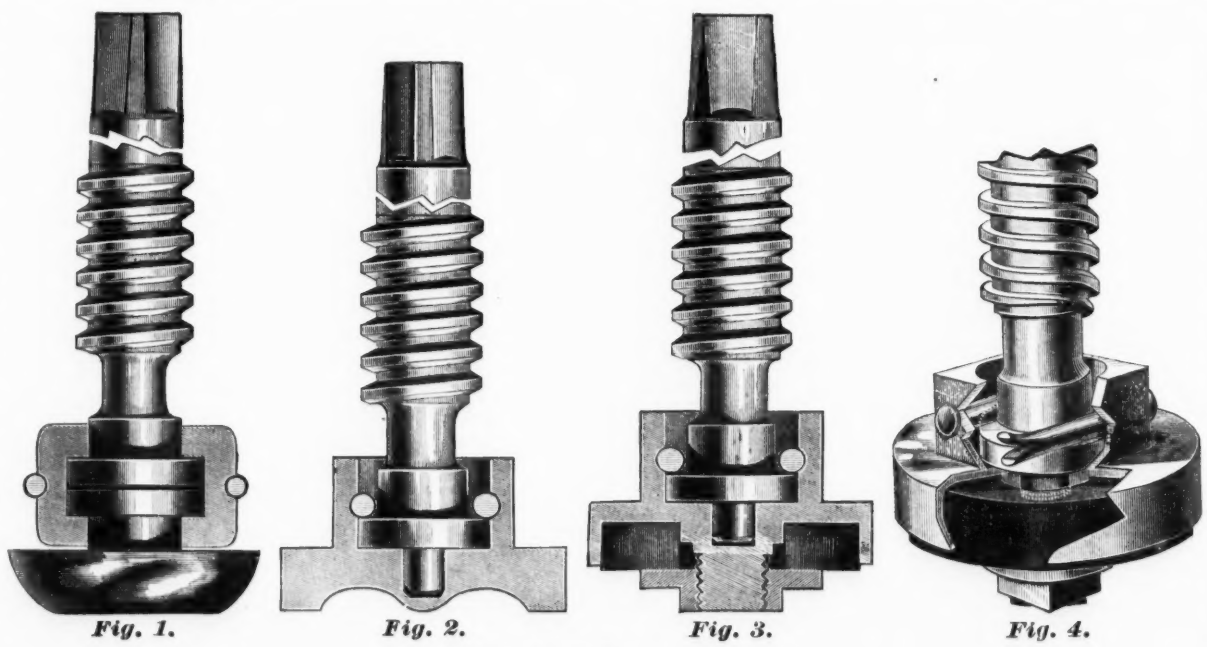


Fig. 1. *Fig. 2.* *Fig. 3.* *Fig. 4.*

NEW GLOBE VALVE DISKS.

Professor Dewar gave a very interesting lecture at the Royal Institution a few days ago on liquefied oxygen and liquefied air, of which yesterday's *Times* contained a good report. He produced both liquefied oxygen and liquefied air, the oxygen in pints, and even the liquefied air was handed round in claret glasses. Liquid oxygen boils in air at —182° centigrade—that is, 182° of the centigrade scale below zero. The liquid oxygen placed between the poles of Faraday's great magnet behaved like a metal, leaping up to the poles and clinging to them till it disappeared as gas. But liquid oxygen, though so strongly magnetic, is a very bad conductor of electricity. It is a non-conducting magnet. He showed, too, that, so far as chemists can judge, there is probably no oxygen in the sun—the oxygen of the earth's atmosphere accounting for all the oxygen lines in the solar spectrum. The boiling point of liquid air is —192° centigrade, or 10° lower than that of oxygen. It is not true, as had been supposed, that the oxygen in the air liquefies before the other elements in air; on the contrary, the air liquefies as air and is not resolved into its elements before liquefying. If this globe were cooled down to 200° below the zero of centrigrade it would be covered with a sea of liquefied gas 35 feet deep, of which about 7 feet would be liquid oxygen.—*London Spectator.*

American Tin-plate Works.

A trip to that peculiar region of the earth's surface known as the gas belt of Indiana recently brought a visiting party, including a representative of this paper, to the new town of Elwood. It is said every rule has its exception. In this country the rule according to which most railroads are run seems to be that of keeping the country back, and only furnishing facilities for its development when forced to do so, and then a little slower than its development requires. The division of the Pennsylvania Railroad known as the Panhandle, running through this place, has a superintendent, W. B. Leeds, who, in addition to being an excellent railroad official, is also a thorough business man and organizer of business enterprises, and so long as his railroad work is well done the railroad company are willing to let him "grow up with the country," knowing that its freight and passenger receipts will be correspondingly increased. This policy has already made the division one of the most profitable on the road.

The town of Elwood lies where, two years ago, there was nothing but a naked prairie, and already contains a number of manufacturing establishments employing large numbers of workmen. One of these, the American Tin-plate Co., was organized by Mr. Leeds, who is now its business manager. The company controls about 15,000 acres of natural gas land, and uses for fuel natural gas reduced from an initial pressure of 300 pounds to 8 ounces at the boilers. The buildings are all new, and are all of brick, substantially built, with steel roofs. In the rolling-mill department the "hot mills" are ranged in a row, with the engine in the center, and as each building will contain, in addition to the furnaces, only a single row of mills, the workmen will not be sandwiched in between rows of roaring furnaces, as must be the case in a wide building, but will have the benefit of ample air and ventilation. The buildings are certainly well planned. Two Stirling boilers and a Porter Hamilton engine supply power to the four stands of "hot mills," which began work on Monday, June 20. At present the company buys its steel of Pittsburgh manufacturers in the form of "bars," and rolls them down to the thin sheets required for tin plates.

The "cold rolling" department has its separate engine and four stands of mills, which latter, like the "hot mills," were built by Robinson, Rea & Co., of Pittsburgh.

The tinning department is arranged to accommodate ten "stacks," only five of which are yet in place. The latter also began work on June 20. The tinning "pots" are of the "Morewood," or Welsh pattern. In Wales, during the last few years, too much regard for cheapness has brought about the gradual introduction in many establishments of muriatic acid as a fluxing material, instead of the palm oil formerly used, and still used for that purpose, in those which refuse to sacrifice durability of product to a shilling's reduction in cost per box.

The acid-fluxed plates compare with those fluxed in palm oil, very much as shoddy compares with cloth. The object of fluxing being to cause the tin to adhere to the steel sheet, it will readily be imagined that dipping a sheet wet with muriatic acid into a bath of melted tin, or tin and lead, is bound to leave the germ of rust in every sheet, so to speak, such as must make it unfit for any use in which durability is an object, as for roofing, package and utensil purposes. The best Welsh makers, however, have steadfastly refused to lower the quality of their product in this way, and it is to be hoped the American concerns which are starting in the business will follow their example. Heretofore the trouble has been that Welsh makers had things too much their own way, and the consuming public have paid millions each year for "rotten" plates without being able to enforce a remedy. Another thing which has caused enormous waste to American users—who consume three-fourths of all the tin-plates made in the world—has been inaccurate shearing. Until within a year past, it has been impossible to induce the makers to adopt any suitable mechanism for making the sizes of plates what they purport to be—a consideration of great importance where sheets are cut up by the million, as in the manufacture of cans and other packages.

In the Elwood works three men are employed at each pot to do the tinning, which is by no means the simple process it is sometimes represented to be, and three women or boys are occupied in cleaning the plates as they leave each pot. Of course the preliminary "pickling" processes and the subsequent assorting and boxing work require additional help.

The five tinning stacks now at work, together with the three additional stacks already arranged for, when run night and day, as intended, will give the concern an output of over 500 boxes of tin plates daily. The plans of the management contemplate a further large increase of facilities in every department, in the near future, if present conditions in the industry remain unchanged.

At the time of our visit Col. Ira C. Ayer, of New York, the special agent who has been deputed by the U. S. government to collect statistics relating to tin-plate manufacture in this country, was making a personal inspection of the methods and appliances in use at the Elwood Works.

The president of the tin-plate concern, Col. A. L. Conger, of Akron, O., is also president of another large manufacturing concern in the same town, the Diamond Plate Glass Co., which also uses natural gas as fuel. The plate glass works now occupy buildings covering nearly twelve acres of ground, and by a vote of the directors, taken on the day of our visit, new buildings are to be immediately erected and equipped, which will increase the concern's acreage and output fully one-third. The works are said to be the largest plate glass works in the world, though the same company has another, nearly as large, at Kokomo, Ind.

Our representative also visited the new tin-plate works of Norton Bros. at Maywood, Ill. The buildings which have been erected and are now nearly completed are expected to contain machines having a capacity, when fully running, of 2,000 boxes per day, aggregating for this single factory the enormous total of 600,000 boxes yearly, or nearly one-tenth of the whole tin-plate consumption of the United States. At present, however, only two tinning machines are in operation.

While this firm's output is as yet smaller than many of the other American makers, it has made more real progress than any, its efforts from the beginning having been directed, not toward fitting up to run on the methods used in Wales for the past two hundred years, but toward designing and perfecting mechanism looking to the automatic manipulation of the plates, and their efforts in this direction have met with entire success, as can easily be seen by comparing the performance of a Norton machine with the Welsh outfit which they imported, on first deciding to go into the business, in order to show them "how not to do it."

The firm's extensive machine shop at Maywood is now running almost entirely to produce a line of the Norton tinning machines, to supply their own and other factories wanting them. Two of these machines, after a careful personal examination made by its manager, have lately been ordered for shipment to the Fairwood Tin-plate Works, of Gowerton, near Swansea, Wales, furnishing evidence that Yankee ingenuity is getting to be appreciated there, even though the transaction involves something very like "carrying coals to Newcastle." No "acid plates" will be made in the Norton Works, and none can be made on the Norton machine.

A correspondent writes us: There is a distinctive feature in the great machinery business of Cincinnati, O., in that the foundry part of it is conducted entirely as a separate business by different people and capital. The large concerns, such as the Egan Co., J. A. Fay & Co., Lodge & Davis Machine Tool Co. and the smaller houses, do not run any foundries in the building of machinery. All castings, light and heavy, are contracted for and delivered as wanted by

founders who make a specialty of this class of work. This, I believe, is a practice peculiar to Cincinnati only, and, from all we can learn, this condition of affairs seems to be eminently satisfactory.

Cogging Wheels.

BY JOSEPH HORNER.

I.

"Cogging wheels" signifies the fitting of mortise wheels with wooden teeth, a practice adopted to diminish noise in running, and lessen vibration. It is the work of millwrights, and frequently also that of pattern makers. I have done a fair share of it in my time, both new and in the way of repairs. I propose not only to describe the mere fitting and working of the cogs, but also the construction of the patterns for casting the mortise wheels from, both of the spur and bevel form, thus rendering these papers full and complete.

Mortise wheels are molded both from whole patterns and from segmental blocks, with the aid of machines.

Fig. 1 shows the pattern for a spur mortise wheel. The pattern is shown in the half-section to the right hand, and the casting in the half-section to the left. Excepting that prints for the mortise cores are substituted for wheel teeth, they do not differ from ordinary spur wheel patterns. The general method of construction of such patterns is, very briefly, as follows:

The rim *A* is always built up in courses of segments. There are six or eight separate segments to the circle in a wheel of from two to four feet in diameter; in larger wheels there are more. The segments are from about $\frac{1}{2}$" to 1" thick, according to the depth of the rim; the more segments within reasonable limits the better, because they mutually secure one another. They break joints that is, the end joints alternate. The external and internal diameters of the rim are not turned until the whole of the series of segments is complete.l, excepting, however, the zone *a*, which corresponds with the thickness of the arms. And to make a strong job, these arms must be framed and inserted when the ring is built half way up, thus:

The arms are first made by planing up three strips, Fig. 2, wide enough to cut out the arms and their radii, and these are locked together in the center by cutting one-third of the thickness out of each, the strips being set at angles of 60° with each other. Fig. 2 shows the strips as they appear after being cut out in readiness to be locked together. *A* is the bottom, *B* the middle, and *C* the uppermost in the arrangement. *A* is first rebated out, *a*, at an angle of 60° with the sides, to a depth of two-thirds of the thickness. *B* is cut out at *b* at the same angle to a depth of one third, and fitted over *A*, *c c* in *A* and *B* are planed out to one-third in depth, and then *C* is cut at *d* to a depth of two thirds, and, embracing the edges of both *A* and *B*, locks them together, and the outer faces of the three pieces are flush.

Upon the strips thus locked together, Fig. 3, the shape of the arms is marked, but the ends are left $\frac{3}{4}$" or 1" longer than the interior of the rim, to be let into the rim, as shown dotted at *b*, Fig. 1. This is done in order to give them a firm fixing, which they would not have if they were merely abutted inside the rim, instead of being let into recesses cut in the segments. The hollows with which the arms merge into the rim are worked in the solid, as shown in Figs. 1 and 3.

When the segments, therefore, have been built up as high as the line *C*, Fig. 1, which corresponds with the top face of the arms, the arms, Fig. 3, are laid upon the face *c*, and lines scribed round the edges of the extended ends *b*. The recesses in the rim are then cut out by these lines, the arms driven in, and the remaining segments built up on the top of them. The turning is then completed, both within and without the rim.

A little taper, say not more than $\frac{1}{16}$" in the diameter, is given to the outside *d*, Fig. 1, but considerably more, say $\frac{1}{4}$" in diameter, is given to the inner face *e*.

The bosses *f* are next turned, and the vertical arms *g* prepared. The bottom boss and sets of arms are screwed on fast to the flat arms; the top boss and its arms are doweled loosely upon the flat arms.

Thus far the work of making the wheel has been precisely the same as that for an iron-toothed wheel. But now instead of teeth, prints are made to carry the mortise cores. The prints are shown at *h*, Fig. 1, but the enlarged view, Fig. 4, of a print shown in relation to the rim will give a better idea of how it is done than can be gathered from the general view given in Fig. 1. The print *h* is made of the same width at the bottom as the mortise; thence it is tapered to the top, the taper being quite equal-sided or symmetrical. It is not excessive, but may average about $\frac{1}{16}$" on each side for every five or six inches of depth. The print is carried right up to the top of the pattern, notwithstanding that the mortise stops short at the line *J*. This is done to save the trouble and

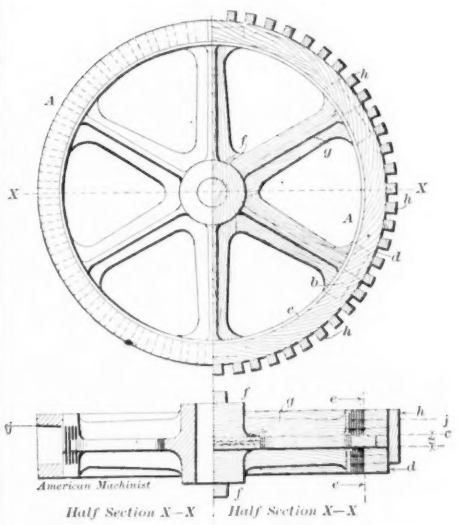


Fig. 1.

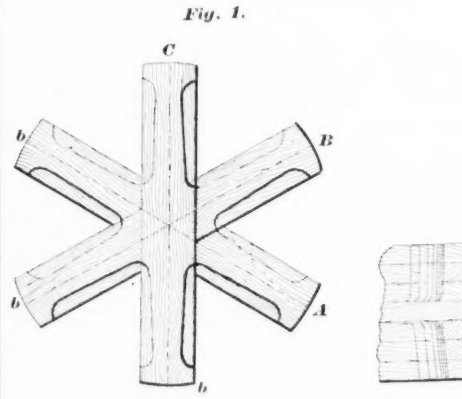


Fig. 3.

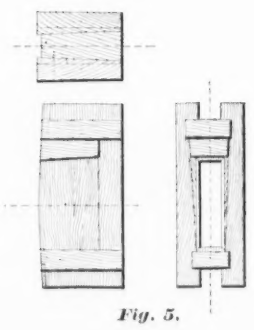


Fig. 5.

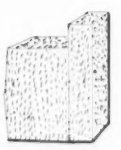


Fig. 6.

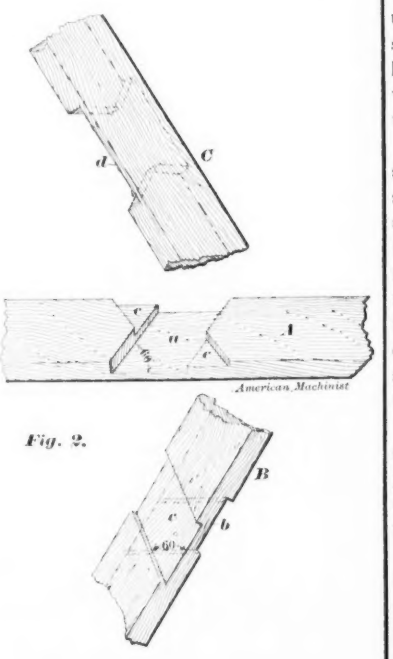


Fig. 2.

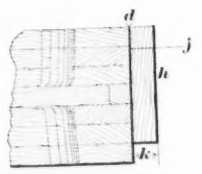


Fig. 4.

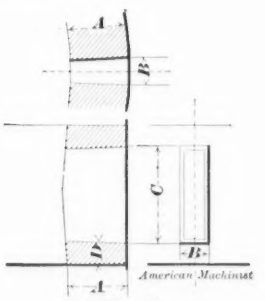


Fig. 7.

COGGING WHEELS.

of the cogs of mortise wheels, the rest of the proportioning is almost entirely empirical. The rules which I have used are these: The thickness of the rim *A*, Fig. 7, is equal to the pitch of the wheel. The thickness of the cogs at the pitch line equals $\frac{6}{10}$ the pitch, leaving $\frac{4}{10}$ for the thickness of the tooth of the iron wheel. The length of cog from pitch line to root equals $\frac{8}{10}$ the pitch, and from pitch line to point $\frac{1}{4}$ the pitch. The width *B* of the mortise at the shoulder = $\frac{1}{2}$ the pitch, and its length *C* also under the shoulder from $\frac{1}{4}$" to $\frac{1}{2}$" less than the face of the cog, dependent upon the size of the teeth. These proportions leave relatively little for shouldering, for wide shoulders are a fruitful source of fracture when driving in the cogs. These proportions do not admit of wide shoulders, yet they allow sufficient for good bedding, and do not unduly weaken the rim. The metal *D* at the end of the mortise should be $\frac{4}{10}$ or $\frac{5}{10}$ of the pitch.

inaccuracy involved in jointing down the top part of the mold to the line *j* against the square face *d* of the wheel. It is easier to make cores to "stop off," or fill up the excess of print above the line *j*, than to joint down. Lastly, the prints must have substantial thickness or width *k* to support the core without risk of the core crushing the bottoms of the print impressions. The drawing is proportional. The prints may range from $\frac{3}{4}$" to $1\frac{1}{2}$" in width, *K*, Fig. 4, depending on the size of the wheel.

The core box for the mortises is made in such a way that the molder is put to no trouble in stopping over the cores. The whole of the print impression, as well as the mortise, is filled up with the core. The box is shown in Fig. 5, and a comparison of the core, Fig. 6, made from the box, with the print in Fig. 4 and mortise in Fig. 7, is sufficient to establish the relationship between the two, so that no explanation is requisite.

If we except the question of the strength of the cogs of mortise wheels, the rest of the proportioning is almost entirely empirical. The taper of the mortises must not be excessive. I give $\frac{1}{8}$" on a side for each $1\frac{1}{2}$" of depth, which is sufficient.

There is by Eastern papers a captious opposition to all the material interests of the World's Fair at Chicago that is, to say the least, what would in some parts of the country be characterized as "low down." New York was fairly and squarely beaten as to the location of the Fair, but Chicago is in the United States, and is a mighty smart speck on the atlas. By all means let the Fair boom.

The Philadelphia & Reading Railroad statement for May shows gross traffic receipts of $1,829,209 against expenses for same period of $1,018,377; profit on operating expenses, $810,831. The surplus for the first six months of the year is $1,046,578, an increase of $692,090 compared with same period last year.

LETTERS FROM PRACTICAL MEN.

The Placing of Globe Valves.

Editor American Machinist:

Considerable has been written of late concerning the placing of globe valves, and there appears to be a majority in favor of placing the bottom of the valve to the pressure.

Many men, however, give this question no thought, and when a job of this kind is on hand, whichever way they happen to get hold of the valve, that is the way it will go on.

Convenience should figure largely in the proper position of a valve. It is not convenient to have the water of condensation continually dropping from the stem of a valve. Neither is it convenient to place the bottom of a globe valve to the pressure when it is better to place the top to the pressure.

For instance, a valve is to be placed in a vertical steam pipe, the pressure from the upper end. Then the bottom of the valve should go to the pressure. On the other hand, if the top is put to the pressure, water will be continually leaking from the stem when the valve is closed.

If a valve is to be placed in a horizontal steam pipe, and it is convenient to point the stem slightly upward, the top of the valve should go to the pressure, for the reasons that the valve will seat much better, and not near so liable to leak steam; and it doesn't require as much strain on the stem threads to open a valve against the pressure as is required to close it against the pressure, and seat it firm enough to prevent the valve from leaking.

Again, should it be necessary to point the stem downward, it will also be convenient to place the bottom of the valve to the pressure, otherwise condensation would be leaking from the stem while the valve is closed.

I invariably place the top of mud valves to the pressure, for the reason that they seat easier and better, and are far less liable to leak. A leaky mud valve is an abomination. It is far better to drain the boiler through the hand-hole than to have the mud valve blow open with fire under the boiler.

The bottom of water-feed valves should be placed to the pressure.

When two or more boilers are in use in one battery, and connected only at the steam pipes, each boiler must necessarily have its own feed valve, and they are necessarily worked considerably in regulating the feed water, and their proper place is in front, near the water gauge. About four years is the average life of the stem threads of such a valve. Placing the bottom of these valves to the pressure, or, in other words, toward the pump, they will be held open, as they should be. The stop valve between the check valve and the boiler can be used to regulate the feed until such a time that the feed valve can be fixed or replaced.

Stop valves in steam pipes near the boilers should be placed with the bottom of the valves to the boilers. In case of a single boiler the valve can be used in cold weather, or when anything is wrong with the throttle valve.

In case of two or more boilers, when necessary to take one out of service, the pressure from the other boilers comes upon the top of the closed valve, holding it to its seat, thus preventing any danger from that source to any one working inside the boiler. The stems of these valves should be placed in—or a little upward—from a horizontal position, so that no pocket is formed to hold water while the valve is closed.

I saw in the *Locomotive* for last month an engraving showing a system of connecting boilers set in battery to a steam main. Angle valves are shown at the upper end of the riser, and the engraving shows the stems of the valves in a horizontal position, bringing the pressure on the bottom of a closed valve. While the valve wheel is in a convenient position, at the same time it is not in a proper position for a man working inside of one of these boilers with pressure on the rest of the battery; it is nothing more than a death trap.

Make the valves convenient by turning the stems upward, and the top to the pressure,

and the wheels arrangement somewhat inconvenient, if essential for safety.

S. A. SMITH.

Blowers and Fans.

Editor American Machinist:

The writer has just finished reading an excellent article on melting cast-iron, by S. M. Bolland, in the AMERICAN MACHINST for June 30. The greater part of this article corresponds very closely with our experience. We must, however, take exception to the tables of his laid down, especially that part wherein he gives the size of our blowers required to melt a given amount of iron, and the horse-power to drive same. We think the mistakes made are more due to an oversight on the part of Mr. Bolland than anything else, for certainly foundrymen know that it does not take as much power to run our blowers at the pressure of from 6 ounces upward as it does a fan, while Mr. Bolland has in part of the tables put it down that our machine requires from four to five times the power of the fan to do the same work.

We think the mistake made by Mr. Bolland occurred through his assuming that the Sturtevant and ours were numbered in the same way, *i. e.*, the machines having the same numbers had the same capacity. For instance, he says that our No. 5 blower, giving a pressure of 10 ounces, melting 7,550 pounds of iron per hour, requires 17¾ horse-power, while the Sturtevant blower, to do the same work, requires only 5½ horse-power. The above horse-power is what we state will be required for a No. 5 when running at its maximum speed, and melting 21,000 pounds per hour at a pressure of 12 ounces. Our No. 3 machine would have been the size to have compared with the No. 5 fan. This machine, running at a speed of 235 revolutions per minute, would discharge 1,880 cubic feet per minute, or 112,800 cubic feet per hour, which would melt at the rate of 3¾ tons per hour, allowing 30,000 cubic feet of air to the net ton, which is the amount that long years of experience has shown us is correct. This machine will require 6 horse-power to drive it, while the Sturtevant claims to be able to do the same work with an expenditure of only 5½ horse power. The theoretical amount of power required to compress this amount of air is $5\frac{5}{33}$ horse-power. We do not believe that any fan can do this work with such a small allowance for friction, etc.

In numerous tests that have been made between the fan and our blower, it has been found that, at a pressure of from 12 ounces up, the fan requires 30 per cent. more power to drive than the positive machine, doing the same work. Below we give a table showing what sizes blower should be used to do the same amount of work as given in table by Mr. Bolland, and we trust that he will look into this and see if the figures are not correct.

Melting Capacity in lbs. per hour.	Diam. of Cupola.	Number of Roots' Blower.	Rev. per min.	Horse-power required at the given pressure.	Pressure in Ounces.
1,500	24	½	250	¾	6
2,000	26	½	335	1	6
2,500	28	1	210	1¼	6
3,000	30	1	250	1½	7
3,500	32	1	292	1¾	7
4,000	34	1	333	2	7
4,820	36	2	241	2½	8
5,640	38	2	282	3½	8
6,4 0	40	2	325	4	8
7,550	42	3	235	6	10
8,640	44	3	270	7½	10
9,730	46	3	304	8½	10
10,760	48	4	212	10	12
11,790	50	4	236	12	12
12,820	52	4	256	13	12
13,850	54	4	277	14	14
14,880	56	5	170	16	14
15,910	58	5	180	17½	14
16 940	60	5	192	18½	14
18 340	62	5	208	20	14
19,770	64	5	225	22	14
21.200	66	5	240	23	14
22,630	68	6	142	25	14
24,060	70	6	150	27	14
26,070	72	6	163	33	16
27,980	74	6	175	35	16
29,890	76	6	187	37	16
31,800	78	6	200	40	16
33,710	80	7	140	42	16
35,620	82	7	148	45	16
37,530	84	7	160	47	16

D. T. ROOTS,
Pres. P. H. & F. M. Roots Co.

The Trolley System.

Editor American Machinist:

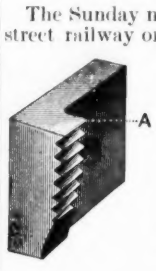
I see by a letter in your paper that one of your correspondents claims that no one had ever been killed by the trolley system. Find inclosed clipping from Grand Rapids (Mich.) daily, in which it refers to the killing of a man and his horse at the same time. I think that it would be quite easy to find any number of such cases. I have yet to see a manager of the trolley system that did not feel entirely sick of the thing, and wish that it might be displaced with something better.

Lansing, Mich. SAMUEL E. JARVIS.

Following is the clipping referred to in the above.

DOESN'T AGREE WITH MR. CHAPMAN.

The Sunday morning edition of one of the street railway organs has the following exclusive item:



"One of the wires supporting the trolley wire at the corner of Canal and East Leonard streets broke last night about 8:30 o'clock and the trolley wire fell to the road. Luckily, no teams were passing at the time, and no one was shocked. Word was immediately sent to the power house, and the current was cut off. Traffic on that line was delayed about an hour, until the linemen could repair the break."

According to the sworn testimony of Manager Chapman at the Hydorn inquest, there was no occasion to stop traffic for a moment, and no danger in case teams were passing, as Mr. Chapman at the inquest swore there was not enough power in the wire to kill a man even at Bridge street, and the current a mile farther from the power house must have far less force than it had when Mr. Hydorn met his death, and a strong, healthy horse was also killed at the same time.

To Grind Rubber.

Editor American Machinist:

If "J. S. W., St. Albans, Vt.," wishes to grind rubber, he can do so by using a coarse emery wheel (a very coarse one), the surface of which must be kept covered with chalk. This may not be a practical way of doing it for the purpose he mentions, but it will do it.

The rubber rolls used in leather-splitting machines have to be trued up by grinding, which is done in an ordinary lathe with a grinding attachment.

The operator holds a piece of chalk on the wheel lightly, thus grinding off a dust of chalk which falls on the roll. This prevents the rubber melting and adhering to the wheel.

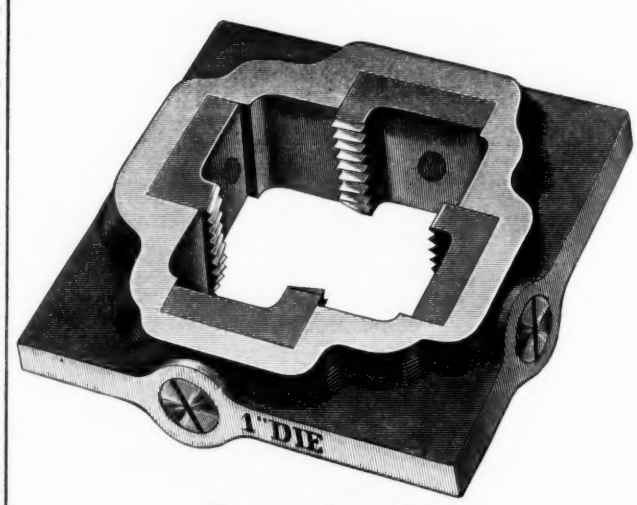
A. W. PARKHURST.

Taking the record for it, the Empire State Express made the run between Buffalo and Syracuse—128 miles—in 123 minutes. It is lively motion.

An Improved Pipe Die.

We present with this, engraving of a new pipe die, which consists of a frame of malleable iron into which is secured four cutters, made of the best quality of steel and properly tempered, their comparatively small size permitting the use of the highest grade of steel at small cost, and also greatly simplifying the operation of securing a good temper.

The cutters are properly relieved for clearance so that they cut very freely, and when dull it is an easy matter to remove them from the frame, grind upon the square front faces and replace—an operation which makes the die cut as well as when new, and one which can be repeated as often as necessary until the cutters are used up. The construction also reduces weight. A die stock is furnished for these dies, but they can be used in any stock or in any solid die pipe threading machines using dies of same dimensions. They are manufactured by Pancoast & Maule, Philadelphia, Pa.



IMPROVED PIPE DIE.

Combined Automatic Return and Drain Steam Trap.

This trap is designed for returning the water from a steam heating system under pressure back into the boiler, or it can be used to force the water from a reduced pressure system to a tank or hot well from which it is to be pumped into the boiler; it can also be used in connection with a regular special bucket return steam trap to return the condensed water back into a boiler from a building situated at a distance from the main building, or its source of steam supply.

The mechanical construction of this trap differs from the regular return steam trap in that the discharging pipe (see Fig. 2) leading from the trap is arranged with a valve that is automatically opened and closed by the water received and discharged from the trapping vessel.

By this arrangement, when the trap is used in connection with a system other than returning direct into a steam boiler, the steam is prevented from passing through, and escaping to the atmosphere, in the same manner as the ordinary drain steam trap that is designed simply to allow the water to escape and retain the steam, commonly known as a drain or non-return steam trap.

In this class of non-return traps there is no pressure in them other than what may be in the system to which it is connected for draining. As all of this class of traps (non-return) must be placed below the heating system to allow the water to flow by gravity into them, it will depend entirely upon the pressure in the heating system as to how high the water may be elevated and discharged into a receptacle for it. It often happens that the pressure in the heating system is not sufficient to elevate the water to the receiving tank, usually located in the boiler room.

By the use of this combination the water of condensation from a heating system any distance from and below the boilers, or the source of its steam supply, can be returned under pressure back into a tank located in the boiler room, to be pumped or trapped back into the boiler, there being no openings to the atmosphere.

It often happens that the hot water from a system having in it a pressure of a few pounds above the atmosphere is required for use on one of the upper floors of a building, and this distance may be fifty or sixty feet above the trap, limited only by the pressure in the boiler.

The operation is as follows: When the trap is filled with water the bucket drops, and at the same time opens the equalizing valve (see Fig. 1) communicating with the steam space of the boiler, admitting the boiler pressure steam into the trap.

This steam pressure on top of the water forces it out of the trap up into the elevated tank or other receptacle provided for it. After the water is discharged from the trap the bucket will rise, closing the equalizing valve that communicates with the boiler pressure, when the water will again flow into the trap, and it will continue working automatically until the boiler pressure is shut off.

It may be well to say here that this device has no packing boxes, no pistons and no moving parts outside of the trap vessels; it requires no oiling, and, in a word, no more attention than a good gas or water meter. It is manufactured by the Albany Steam Trap Co., Albany, N. Y.

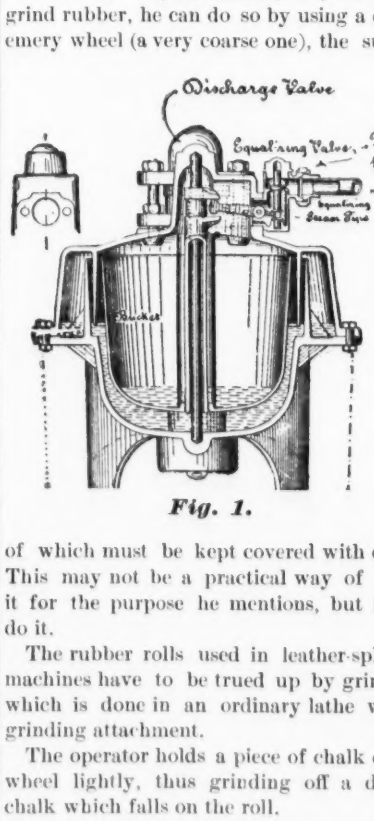


Fig. 1.

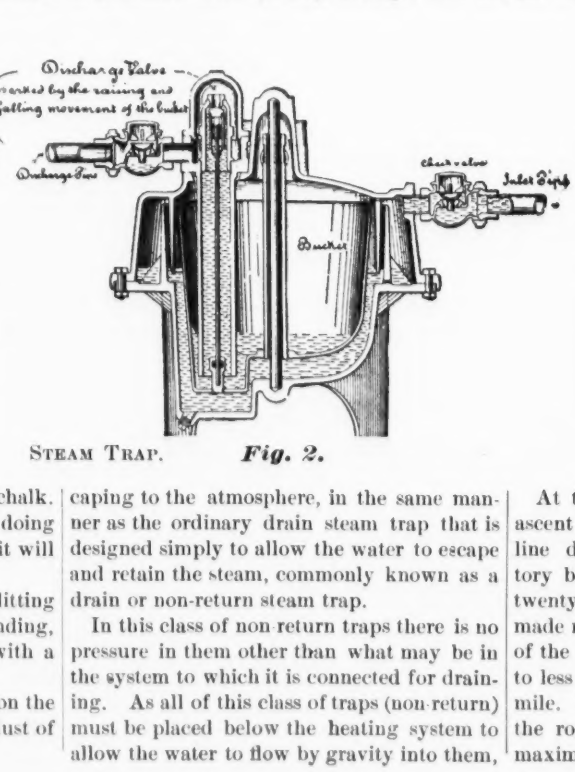


Fig. 2.

STEAM TRAP.

Lick Observatory.

(*Editorial Correspondence.*)

Within easy reach of San Francisco is a spot which should be regarded as a sort of shrine by every mechanic, because there are gathered there a number of pieces of mechanism which represent in many respects the very highest attainments of mechanical science.

At the close of the sessions of the American Society of Mechanical Engineers in San Francisco, Secretary Hutton, Mr. F. A. Scheffler, superintendent of the Brush Electric Works, and myself, started on Saturday morning for San José by rail; finding awaiting us at the station there a previously engaged carriage which was to take us over the 28-mile drive to the top of Mount Hamilton, the location of the Lick Observatory—the largest and best telescope in the world, and many other things of great interest to a mechanic, engineer or scientist.

There is a regular stage line which carries visitors up and down the mountain between San José and the observatory, but we preferred a conveyance the movements of which we could control, and thus not only be more comfortable, probably, but also economize our time as much as possible. The first four miles of the road out from San José (which, by the way, is always given the Spanish pronunciation of San Hoo-zay—with the accent on the final syllable) is over a comparatively level road, bordered on either side by rows of fine shade trees, which, on this day, were particularly appreciated, for the weather was very warm.

At the end of this stretch of road the ascent of the mountain is begun, the air line distance from here to the observatory being sixteen miles, while the road is twenty-six miles long, this extra length being made necessary by the detours and windings of the road needed to keep the grade down to less than 6½ per cent., or 343 feet to the mile. During the first portion of the drive the road rises rapidly, keeping near to the maximum grade, and every turn reveals the

most sublime views of the Santa Clara valley, in which San José is situated, and of the surrounding mountains, the white dome of the mammoth telescope being frequently seen, and looking always as though it were over in the next field only, and within a few minutes' easy walk. Across the valley, thirty miles away, is to be seen the dark top of *Loma Prieta* (Spanish for Black Mountain) the highest peak in the Santa Cruz mountains—3,790 feet high.

The road is an excellent one, as indeed it must be, for it affords the only means of getting up and down the mountain, all the instruments and much of the material for the observatory building having been transported over it; the bricks, however, being made near the site of the observatory, where, luckily, suitable material for them was found.

We reached Smith's Creek in time for dinner at the hotel there, having stopped frequently to rest our horses and ourselves under such shade trees as offered their grateful services, or to admire a particularly fine view, or a, to us, new mountain flower, of which there were many extraordinarily beautiful varieties, their character and colors changing with the increased altitude as we ascended. It seems, too, to be a favorite locality for lizards, innumerable small black specimens sunning themselves upon the rocks by the roadside.

There are no hotel accommodations at the top of the mountain, the nearest hotel being at Smith's Creek, which is distant from it two miles plus 600 feet in a direct line, though by the road it is seven miles, the difference in altitude between the two places being 2,152 feet, and the altitude of the observatory floor 4,209 feet.

We arrived at the top of the mountain about 4 P. M., and, sending in our cards by the janitor, to Professor Holden, the director, to whom letters of introduction had been previously sent, we were soon joined and cordially welcomed by him. A very few moments' conversation with this man served to show that Lick Observatory has other wonderful features besides those commonly associated with it, and among these, not the least by any means, is Professor Holden himself. His splendid enthusiasm, his entire devotion to his favorite science, to Lick Observatory, and to all things connected with it, are manifested in every word and action, while his apparent entire forgetfulness of himself, and his unassuming manner, seemingly without consciousness that he is one of the most prominent scientists in the world, make a personality that is exceedingly attractive.

Naturally our greatest interest centered in the telescope, under the seventy-five-foot dome at the south end of the observatory building, and there we were piloted by Professor Holden, who, as we stood upon the circular floor under the telescope, directed our attention to its chief points of difference from other similar instruments.

As our readers know, this telescope, the largest refracting instrument in the world, was mounted, *i. e.*, its machinery, pier and tube were constructed by Warner & Swasey, of Cleveland, Ohio, who are represented here also by other minor instruments, while the great objective, of 36" clear aperture, was made by Alvan Clark & Sons, of Cambridge, Mass. Mr. John A. Brashear, of whose place in Allegheny City I gave an account in issue of July 9, 1891, is also represented here by instruments of his make, his spectroscopes, for which he is especially famed, being used in the spectroscopic and photographic work to which the observatory is particularly devoted.

The dome and the floor under it, which latter is made to rise and fall to suit the position of the eye end of the telescope, were constructed by the Union Iron Works, mainly from designs of Prof. Holden, the details being worked out by Mr. Dickie and Mr. Fraser. The dome itself is a steel structure, exhibiting admirable workmanship and design, the movement of the dome, though it weighs, including all moving parts, 199,000 pounds, being effected by direct application of a force of 200 pounds. This freedom of movement is accomplished by the use of what is known as the floating ring, which consists of a series of rollers on which the dome rests, these rollers being held in place and kept upon the circular track by means of links which allow them to adjust themselves perfectly, expansion and contraction of the dome by changes of temperature—amounting to about $\frac{1}{2}$"—being provided for by allowing the track to slide upon lubricated bearing-plates resting upon the brick wall which constitutes the foundation for the dome.

The dome can be easily moved by one hand applied to a crank, but is usually moved by a small hydraulic engine, which can rotate it 360° in something less than nine minutes. Most of the bearings are fitted with steel balls to reduce friction. The opening in the dome through which the telescope is pointed is 9 feet 6' wide and is closed by shutters which weigh 16,000 pounds; the total weight of metal used in the dome, plate, etc., being 269,000 pounds.

Of the telescope itself it is difficult to acquire any clear idea or conception short of seeing it, and looking through it. Its lens, gathering 32,400 times as much light as falls upon the human eye, and with a focal distance of 56 feet, is mounted at the end of a nearly cylindrical steel tube, at the opposite end of which is the most intricate and complete system of microscopes or eye-pieces for magnifying the image formed by the objective, micrometer attachments for measuring angular distances between celestial objects, photographic apparatus, and innumerable hand-wheels, by which, from his position, the astronomer can move the telescope in any desired direction, or control the clock and its connection with the rest of the mechanism, by which, when properly set by the various graduated circles, the great tube is swung around at such a rate and in such a direction as to make it exactly follow the motion of any observed celestial body.

So perfectly is the great weight of the tube and its attachments balanced, and so thoroughly is the effect of friction eliminated that the pressure of two fingers directly upon the tube easily moves it, though, of course, on account of its great mass, it yields to the pressure quite slowly at first, this sluggishness of movement being the only thing to indicate its great weight.

The magnifying power which it is practicable to use with a given telescope depends primarily upon the light-gathering power of the objective lens, and different powers are used in the same telescope, depending mainly upon the object looked at and upon the condition of the atmosphere. The statement made above regarding the light-gathering power of the Lick telescope means that a star about 30,000 times fainter than the faintest visible to the naked eye can be seen through this glass, and a magnifying power of more than 2,000 diameters can be used on suitable objects and under suitable conditions.

This high power cannot, however, be used to advantage on any of the nearer celestial objects, such as the moon or planets of the solar system, 1,000 to 1,500 diameters being about the maximum for these. Viewed thus, the moon appears as though seen by the naked eye at a distance of about 200 miles, at which distance objects about 300 feet square would be distinguishable. This does not realize the hope of Mr Lick who thought his bequest might enable a telescope to be built that would show animals on the surface of the moon, provided any were there, which, however, is not at all likely.

Changes have been made in the appearance of the surface of the earth by the agency of man that would be readily recognizable by such a telescope placed upon the moon. Our largest buildings, our harvest fields, and the effect of hydraulic mining operations would be readily seen, so that a highly organized life, if any existed there, would probably manifest itself indirectly.

At the time of our visit the planet *Saturn* was the most available object for showing the power of the instrument, and this, appearing to the naked eye as simply a pale star, appeared through the tube to be about the size of the full moon; its rings appearing as a straight bright line, since at this time they were almost exactly in the plane of our vision. In the same plane four Saturnian moons or satellites were visible, the whole forming a picture of great beauty and impressiveness.

Spectroscopic work as now carried on in observatories is considered to be among their most important work, because by it the composition of the heavenly bodies may, with almost absolute certainty, be determined. In this work the Lick telescope excels, both on account of its light-gathering power and its location, the air and meteorological conditions here being undoubtedly better than at any other observatory in the world, thus enabling the spectra of stars to be examined here whose spectra would be too faint for examination under less favorable conditions.

It may be well to give here an outline of the principle of the spectroscope and its work, so that we may understand how by its assistance the astronomers on Mount Hamilton are enabled to be almost sure that they know what substances or gases, in the main, constitute most of the visible heavenly bodies, and, also, whether a given star, which may be countless millions of miles away, is approaching or receding from us, and if either, at about what rate.

If light falls upon and passes through a triangular prism it is resolved into its component parts or colors, and when thrown upon a screen or other white surface these colors appear in regular order as seen in the rainbow—violet, indigo, blue, green, yellow, orange, red. This band of colors so formed is called a spectrum, and when the light thus separated comes from a solid body the spectrum is continuous, while if it is derived from a luminous, gaseous body, the spectrum is usually not continuous but broken by dark spaces which are interposed between the various bands of color. The spectrum of any given gas is always the same, and is readily recognizable. It is found, moreover, that when the light comes from a luminous solid body, and passes through a less highly heated gas, this gas will absorb or retain all the colors of the spectrum which by itself it would have shown. That is to say, the spectrum of a solid body, the light from which has passed through a gas, will be the continuous spectrum of that solid body minus the bands of color which would appear in the spectrum of the gas itself if heated; these bands of color being replaced by black bands.

By carefully comparing spectra thus obtained with those obtained in laboratories from heated bodies and gases, conclusions are arrived at concerning the composition of the gases and of the bodies enveloped by them, which seem as certainly correct as most human knowledge can be.

In order to understand the method by which the motion of a star towards or away from the earth is determined and measured by the spectroscope, it will be well to briefly review some points in the theory of light.

Between sound and light there is a close analogy, each being projected from its source by means of vibrations of the air or other medium, the intensity of the sound or light affecting the amplitude of the vibrations, while the pitch of the sound is higher as the number of vibrations per second increases, and the colors impressed upon the retina also depending upon the rapidity of the vibrations of the ether; red corresponding to comparatively slow vibration, corresponding to a deep-toned note, while violet is the result of much more rapid vibrations, and corresponds to a higher pitched note or sound.

We have all noticed, when riding upon a rapidly moving train, that the note or tone of an engine bell which may be approaching us on another track suddenly drops as we pass the engine, the difference in pitch depending upon the relative speed of the two trains, and sometimes amounting apparently to a full note. With the whistle, if it happens to be blown at the time of passing, the same phenomenon is observed, and the explanation is that, as we approach the bell, our speed of movement towards it is added to the speed of the sound waves proceeding from it, and we therefore receive more vibrations per second, with the result that we hear a higher note; while after the engine passes us the conditions are reversed, our movement away from the bell being subtracted from the vibrations, so that we receive them at a slower rate and hear a lower note corresponding to the lesser number of vibrations received per second.

The same causes produce analogous effects upon the spectrum of a star. If it be receding from us we receive fewer light vibrations per second from it, while if it be approaching we receive them more rapidly, the result of this being that certain lines upon the spectrum are correspondingly displaced, the direction of this displacement and its amount showing whether the star is moving toward us or away from us, and at what rate. This, of course, involves a knowledge of the light wave lengths, and some measurements of the greatest refinement, but no one who follows the method of making these can well doubt that accurate results have been arrived at by them, especially when we know that practically identical results have been obtained at different places, and by different observers working independently. As a result of these observations, it is believed that the star *Vega* is approaching us at the rate of 45 miles per second; *Pollux* at 40 miles; *Arcturus* at 42 miles, while *Castor* is moving away from us at 26 miles per second; *Regulus* at 20 miles; *Procyon* at 44 miles, and so on, the motions of most of the principal stars having been determined by numerous observations. In this work, as I have said above, the Lick telescope should be able to take the lead, on account of its great light-gathering power and its favorable location.

There are, of course, a great many other very interesting instruments here, a description of which would, however, be tedious, especially without illustrations; the arrangements for determining and transmitting accurate time, and those for observing the effects of earthquakes, being among the most interesting.

A spring located about three quarters of a mile from the observatory furnishes the principal supply of water, supplemented by that which falls upon the slate roof of the building. A windmill and a steam pump are used to pump this water to an elevation sufficient to make it useful in moving the dome of the great telescope, and for raising the floor surrounding the pier, as well as for fire protection.

Windmills, by the way, are used very extensively in California for pumping water, a bird's-eye view of the landscape dotted over with them reminding one of a field of daisies, from which some genius among the engineers called them "California daisies," thus hitting off their resemblance to that flower, and at the same time the gigantic size to which things are wont to grow in that country.

Such an object as Venus is, to one who visits this locality for the first time almost unrecognizable, looking as it does, to the naked eye of an observer standing on Mount Hamilton, far brighter than any object ever seen in the sky before, the altitude, rarity and clearness of the atmosphere making it look more like a large arc light hung a short distance off, and constituting one of the most memorable sights of this evening of sight-seeing.

The Lick Observatory, conducted as it is with an especial view to awakening popular interest in things above the surface of our world, as well as to do the most advanced scientific work, is an institution of incalculable benefit, and forms a most noble monument to its founder, who sleeps his last sleep under the pier of the great telescope.

F. J. M.

When one notices the load of mail matter with which a letter carrier starts from the New York post-office, and which he is expected to deliver in a remarkably small space of time, he will never believe that a mail carrier receives too much for his services. He is about the hardest worked man in the community, and he earns more money than he gets for his services.

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The Accident to the Steamship "City of Chicago."

The recent loss of the steamship "City of Chicago," of the Inman line, brings out, very forcibly, the almost absolute safety of ocean travel at the present day, so far as loss of life is concerned. For although there was an unpleasant experience in getting away from the stranded vessel, the lives of the passengers were comparatively safe all the way through. There was something of discomfort, but little of real danger.

This was in part due to the fact that passengers have learned to place confidence in the means employed by the steamship companies to save life in case of an accident—the means of preventing anything like a panic—to the general behavior of the officers and crew that leads to confidence, and partly to a knowledge of the fact that the construction of the modern steamship is such as to combine ability to resist shocks and accidents without cumbersome construction. This is one of the characteristics of the construction of the transatlantic liners of to-day.

The Irish coast is noted for fogs—sunshine and clear nights are the exception. It was during the prevalence of one of these fogs that the "City of Chicago" ran on the rocks that abound on this coast. It was a perilous position, but no one appears to have been unduly excited. The engines were worked slowly to keep her nose between the rocks, so that she should not back off and possibly sink from the breaking in of the forward compartments, then without excitement the boats were lowered and the passengers were transferred to the shore. Here rope ladders were let down the face of the cliff—200 feet—up which the passengers, sandwiched, so to speak, by the crew, to protect and encourage them, climbed.

The truth is that every member of the crew of a great steamship is a hero in his way. He holds his position by virtue of being a hero. Being a hero does not, in his case, command a very big salary; it does not command a very big salary in, for instance, the case of the private soldier. But the emergencies of the case always bring out the men for the occasion. When the time comes, the man who finds your chair for you, on the deck of a steamship, will risk his life for you without a thought of consequences. The fact that he and others will do this, and that they know how to make their work effective, conduces wonderfully to the pleasure of those who travel by sea.

Altogether, the skill of the mechanic and the engineer, and the superb action of the crews when an emergency arises, have combined to make ocean travel about the safest thing that can be indulged in. A vessel may, occasionally, be lost, but the chances are that the lives of the passengers will be saved. There is an almost entire absence of danger in traveling by the great steamships.

The "Pop" Safety Valve.

The loss of steam by the operation of the "pop" safety valve was referred to in a late issue of the AMERICAN MACHINIST, as per the report of the committee of master mechanics on tests of locomotives. The loss was, according to this report, which we believe to have been an excellent one, shown to have been a very considerable percentage of the total steam generated in the boiler. But the committee, apparently, reckoned the loss from two three-inch pop valves blowing at once, and this, we do not hesitate to say, is a condition that should never obtain except in a very rare emergency. In fact, the only remarkable thing in the committee's report is that deductions should be made from the loss of two such valves blowing at once. But the conclusions as set forth lead to the belief that this condition was the one considered in the report.

Now the particular feature of the "pop" valve is its ability to keep the boiler free from undue pressure, and the doing of that without undue waste of steam. This this safety valve will do if judiciously applied and intelligently operated. Between reason and unreason, between an understanding and a misunderstanding of what a device should accomplish there is a wide field of difference.

This is not referred to as in any way implying that the committee of master mechanics attempted to make any point against the "pop" safety valve. It seems to us, simply, that by inadvertence their report conveyed the impression that this particular form of valve is wasteful of steam. We do not believe that, with the care in reason to be expected, this is true.

The old-time safety valve was wasteful of steam in that it only showed an *inclination* to relieve the pressure at the point at which it was set. Beyond that the pressure could be raised from fifteen to twenty pounds without very serious objection on the part of the safety valve. This is a fact too well known by locomotive engineers to require argument. The duty of the "pop" valve is to relieve the pressure at a certain specified point, and if the attempt is made - by accident or otherwise—to exceed this specified pressure, the "pop" valve will waste steam, if the intention to keep the pressure within specified limits is called wasting steam. There isn't the remotest doubt but that the properly constructed and properly operated "pop" valve will keep the limit of pressure within that decided upon. If this is a weakness then it has this weakness in a remarkable degree. No one should use it either on a locomotive or stationary boiler unless the fixing of the maximum pressure is worthy of consideration.

But the arrangement of two three inch valves, upon which the committee reported, on one locomotive boiler, is, in our opinion, wrong. It is entirely impracticable to arrange two such valves to "blow" simultaneously, that is, to arrange them so that they will begin to relieve the pressure in the boiler when it has come to a certain point fixed upon. One valve must be "set" to blow a little later than the other, and this later—by a pound or two—blowing valve must be the real safety valve. That is, it must be the valve, in conjunction with the valve that first blows, above the designated pressure of which it is not possible to raise the pressure in the boiler.

Every manufacturer of "pop" safety valves will guarantee to furnish valves that will meet every requirement in this respect, but when it comes to opening, at once, two three-inch holes in a boiler, not one of them will guarantee that, by the operation of their devices, these holes will be closed until considerable steam has been wasted.

The conception of the modern "pop" safety valve implied that the locomotive engineer should think; and we have no doubt he does think. He makes the device a means for the saving of steam, and a device for the additional assurance of safety.

In all of the foregoing there is no intention to argue that the committee of master mechanics did not attempt to show modern practice in relation to the use of pop safety valves, but if this practice contemplates the simultaneous opening of two holes three inches in diameter in any locomotive boiler ever built, we believe it is wrong practice.

Put In Decent Screws.

Any good mechanic who will go into a machinists' supply store and examine the small tools kept there for sale to machinists, will be struck by the very large proportion of poor threads found upon the various clamping and traversing screws used on these tools. There is no single feature which more readily shows careless and slovenly workmanship, and the wonder is that such screws are used on tools to be sold to men who know their significance and who are annoyed by the sight of them; especially when it is such an easy matter to make fairly good screws.

With the machinery and tools that can now be had for making small screws, they can be made wonderfully cheap, and at the same time good—such screws as no machinist or tool maker need be ashamed to have among his tools. In fact it is very doubtful if fairly good screws need cost any more to make than many of the beastly poor ones seen, for such a low grade of workmanship ordinarily goes with poor and inefficient equipment handled by poor and inefficient men; which means high cost of production.

Where small tool makers do not make a sufficient number of screws to make it worth while to put in a plant for making them right, it will be found to pay, we think, to get them made in an establishment where they have the equipment. Most anything is better than offering to machinists small tools fitted with screws that are drunken, rough, rounded at bottom of threads and broken at the top, looking worse than if made by a "jam-plate" at a cross-roads blacksmith shop.

The Hudson River Tunnel.

Some twelve years ago—something longer, we think—the Hudson River tunnel was begun. Since that time the work has been one of stops and starts, and to-day the prospect of the completion of the enterprise is more problematical, apparently, than ever. The particular standing at present is a mechanic's lien by the contractors against the work already done, and eventually we suppose the courts will decide whether or not the lien is valid. This is not, however, the probable reason for the delay in the work. Like many another scheme, this one had its rise for speculative purposes, and the money to carry it on was not at hand. It cannot be expected that money to carry on such great enterprises will be invested unless there is reasonable grounds for a belief that the returns will be good. But this is not the point. The point is that so many enterprises are started with the expectation—a sort of gambler's belief—that a little investment will win, and in this way the whole matter drags along through years of waiting for something to "turn up," in the meantime the stock being exploited in Wall street and elsewhere, to the pecuniary interest of some of the speculators and the discomfiture of others, and to the discredit of the country.

We believe that when great undertakings, like that of driving a tunnel under the Hudson, are contemplated, and in which authority for the work must be had from State or general government, work should not be allowed to begin until the capital for its completion is shown to be in sight beyond all reasonable peradventure. The slow dragging along of such adventures—the miserable speculative delays—are discreditable to the whole country, in the eyes of the outside world. They give to the country a tone of brag and bluster that does not belong to it. Still it will cling to it unless our habits are reformed.

Ethics of Journalism.

Some weeks since we noticed that a contemporary printed an article as original which appeared not long before on the editorial page of the AMERICAN MACHINIST. We notified the editor, by mail, of the apparent act of forgetfulness, receiving in reply the statement that "Probably we reprinted the article from some of our English exchanges," from which we infer that, according to our contemporary's views, it is legitimate to steal from an English paper, but not quite the thing to purloin from an American paper. Just how the question of ethics involved is made to balance is what bothers us. The English paper probably stole from us, but does stealing from it make things even? We give it up.

An esteemed daily contemporary has just found out that wire is manufactured somewhere in Connecticut that is materially stronger than copper wire; the particular increase in strength is omitted, because of an obvious intention to run skyward in figures.

The Londskrona Kjelflinge Railroad in Sweden has ordered two locomotives of the Baldwin works, their machines being considered better and cheaper than those offered in near-by countries.

The Trouble at Homestead.

All good citizens will keenly regret the scenes of violence at Homestead, no matter what their opinion as to the merits of the original disagreement between the workmen and their employers.

In the situation as it stands at this writing, the first duty of the authorities is to restore order, and there can of course be no doubt but that this will be done, probably long before this reaches the eye of the reader. With the present contradictory reports before us little can be done in the way of drawing definite conclusions.

We do not believe—we have never believed—in the employment of Pinkerton men in the settlement of labor disputes. It always has and always will lead to trouble. They are not a part of the properly constituted civil or military force, and their appearance upon a scene of trouble will always be looked upon as an effort to overawe workmen. It is scarcely worth while to argue the question as to whether this side of the case is right or wrong. It is a fact that a good many years of experience has only tended to intensify the feeling against Pinkerton men in labor disputes. This feeling will not grow weaker; it will grow stronger.

In the very county where the referred to disturbance has occurred the public treasury paid damages to the railroad companies for injuries to property during the railroad riots of 1877, these damages being awarded by the courts, distinctly for the reason that adequate protection had not been afforded by the properly constituted authorities; but when the owners of property undertake to do in their own way what is the duty of the public authorities, and fail, precipitating the trouble, the matter is different.

If it becomes necessary to settle labor disputes by force of arms, the operating army should be in charge of those properly constituted to superintend it, and not in the hands of men without responsibility.

Questions and Answers.

Questions of general interest relating to subjects discussed in our columns will receive attention in this department. The writer's name and address should always accompany the question. Neither correct initials nor location will be published when there is a request to that effect. If questions are enclosed with a business communication, they should be written on a separate sheet.

(287) J. M., New Westminster, B. C., writes: Please let me know through your columns the addresses of some of the mechanical schools in the Eastern States. I have had a fair practical experience at the machinist business, but I want to take a course of one or two years in some school where it is explained thoroughly. *A.*—See answer to question 239 in our issue of June 2, current volume

(288) J. P. M., Fail River, Mass., asks: Please tell me why brass boxes heat, and the remedy? *A.*—Boxes heat for a variety of reasons, the most prominent reason being that they are not properly proportioned; when this is the case there is no known remedy. The use of light or heavy oils, graphite, etc., may, according to circumstances, remedy the trouble. It is a matter of judgment and common sense, pure and simple.

(289) W. K. A., ——, Ill., writes: Please state through your columns why metal patterns are rusted before waxing, and if that is preferable to waxing before it is rusted. *A.*—The combination of the wax and rust gives a smooth surface at a comparatively low cost without expending much labor in giving the surfaces a fine tool finish. Of course, the wax must be applied after the pattern is rusted, the whole is then heated and rubbed down. You cannot rust the pattern after it is waxed.

(290) "Richard," ——, Sweden, asks: Which is the best material to use for case-hardening? Which is the best furnace, and how long a time is required to case-harden small pieces like screws, etc.? *A.*—The best material under ordinary circumstances is bone charcoal. We do not know the best furnace, but you will find the subject discussed in Mr. B. F. Spalding's articles on "Practical Case-hardening" in issues of June 23, 1888; May 22, June 5, 1890. The length of time will depend upon the stock used, and the depth to which it is desired to have the carbon penetrate.

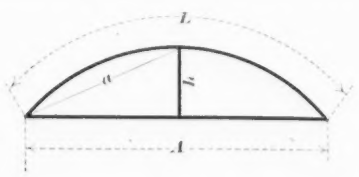
(291) J. H. G., Harvey, Ill., writes: Kindly give me a rule for getting the length of stock for forging a ring or band $11\frac{1}{2}$ inches outside diameter, $1\frac{1}{2}$ inches wide and 2 inches thick. *A.*—The length of stock without allowance for welding is equal to the length of the circumference diameter of which is equal to the mean diameter of the ring. The mean diameter is equal to the outer diameter minus the thickness of metal; in your case we have $11\frac{1}{2} - 2 = 9\frac{1}{2}$ inches for the mean diameter, and the length of the circumference is $9.5 \times 3.1416 = 29.84$ inches, which is also the length of the bar; add to this the necessary amount for welding as indicated by experience.

(292) E. A. S., ——, asks: How can I set taper attachment correct the first time (D. Slate attachment) when taper or angle is marked in degrees? Is there a rule, and if so, will you please give it? *A.*—Taper attachments are not usually marked in degrees, but in taper to the foot, and you generally cannot set them correctly first time. When marked in degrees divide half the taper per foot in inches by 12 and this will give the natural tangent of the angle, which find in a table of natural tangents and set to corresponding angle. Place the tool level with the center. To settle a dispute: 2. How much larger is a 2-inch ball than a 1-inch? *A.*—Twice as large. 3. How ought a punch and force to be made; straight or tapering from the cutting edge? *A.*—Sometimes one way and sometimes the other, depending upon circumstances. Usually they are tapered slightly.

(293) D. H., Seymour, Ind., writes: I have an engine $4\frac{1}{4}$ inches bore, 4 inches stroke, cutting off at $\frac{3}{4}$ stroke; number of revolutions, 275 per minute; steam pressure, 100 pounds. What would be gained by putting on another cylinder and compounding? What size cylinder will be required, and at what part of the stroke should steam be cut off? *A.*—Diameter of cylinder, 7 inches; cut off at about $\frac{1}{5}$ of the stroke in both cylinders; since the cut-off in the low pressure cylinder equalizes the work in the two cylinders, it may be advantageous to arrange the valve gear so as to obtain an adjustment for the low-pressure cut off, although this is not always done for engines as small as yours. The gain will depend on the conditions under which the engine has to work, and the management; you may save from 10 to 15 per cent. of fuel. In answering the above we have assumed that the engine is non-condensing.

(294) Junior M. E., Rochester, N. Y., writes: Please answer the following in your Question and Answer columns. 1. What benefit will it be to a person to become a junior member of the American Society of Mechanical Engineers? *A.*—One of the benefits is the opportunity of becoming acquainted and interchange ideas with men who stand in the foremost ranks of the profession. There are other advantages which should be evident to you if you have the necessary qualifications of becoming a junior member of this society. In our opinion a person who joins a society of this kind simply with an expectation of deriving a direct benefit, does not join it in the right kind of spirit; he should have enough enthusiasm in his profession to prompt in him a desire to co-operate with others in the promotion of the general welfare of society. 2. What will be the cost, and how are the applications made? *A.*—Write to Prof F. R. Hutton, Secretary American Society of Mechanical Engineers, 12 W. Thirty-first street, New York; he will take pleasure in giving you all the required information.

(295) H. B., Milwaukee, Wis, writes: Please give me a formula for finding the height h of an arc when the length L of the arc and its chord A are given only, as shown in the illustration. *A.*—Add to three times the length L of the arc its chord A,



and divide the sum by 8; the quotient will be the length of the chord a. In symbols we have

$$\frac{3L + A}{8} = a.$$

Subtract the square of one-half of the chord A from the square of the chord a; the square root of the remainder will be the height h. This gives a close approximation, but near enough for all practical purposes. The above is based on the formula given in our issue of June 9, page 2, current volume.

(296) H. J. B., St. Louis, Mo., writes: I noticed in one of your issues an illustration of a machine in which 10 rolls, 5 in each set or plane, are used for straightening wire. This straightener is in regard to the number of rolls like one I lately designed for straightening .1 inch Bessemer steel wire, which proved to be a dismal failure. Now I want some information on the subject. Three rolls will bend the wire into a circle; why will not 5 rolls do the same thing, only in a lesser degree? If this is not the case I have the wrong theory. Please give me some light on the subject, as well as your own opinion as to the even or odd number of rolls. *A.*—It may be stated at once that the straightening of the wire depends on the correct adjustment of the rolls. If three rolls, one opposite the space between the other two, are properly adjusted for straightening, they will not bend the wire into a circle, but will tend to straighten it, provided the wire is prevented from turning on its axis. The truth of this must be obvious from the fact that, when the rolls are placed too far apart, they will neither straighten nor bend the wire; but better results will be obtained with more than three rolls, and when two sets of rolls, 5 in each, and one set in a plane perpendicular to that of the other one, and a set of feed rolls are employed, the latter acting in conjunction with the straightening rolls, satisfactory results can be expected. The set of rolls to which you refer do straighten the wire; we have seen them doing it. Your failure was probably due to an incorrect adjustment of rolls, and a feed not suitable for the purpose. The rolls are placed so as to bring those in one line opposite to the spaces between the rolls in the other line, and therefore an odd number is required; an extra roll, so as to make an even number, will be of no use.

(297) J. P. A., San Antonio, Tex., writes: Kindly work the following problem for me, and give me a formula for working similar ones through the columns of your paper. A given tank holds 4,000 gallons, its height is 8 feet, top diameter is one foot less than the bottom; what is the bottom diameter? *A.*—A gallon is equal to 0.1337 cubic foot, hence the 4,000 gallons will be equal to $4{,}000 \times 0.1337 = 534.8$, say 535 cubic feet. The problem now is to find the top and bottom diameter of a frustum of a cone whose height is 8 feet; volume, 535 cubic feet; the diameter of the lower base is to be one foot greater than that of the upper one. We shall first find the diameter of the upper base, which can be found by the following formula:

$$d = \sqrt{\frac{v}{.7854 \times h}} - .083 + .5, \qquad (a)$$

in which d denotes the upper diameter in feet, v the volume in cubic feet, and h the height in feet. Substituting for the symbols their values, we have

$$d = \sqrt{\frac{535}{.7854 \times 8}} - .083 + .5 = 8.72$$

feet for the upper diameter, and $8.72 + 1 = 9.72$ feet for the lower diameter. This formula applies only to a right circular conical frustum with a difference of one foot between the diameters of the bases. In order to enable you to modify this formula so as to make it applicable for any other difference between the diameters of the bases, we shall indicate the method by which formula (a) has been obtained. The rule for finding the volume of a frustum of a cone is as follows: Add together the squares of the two diameters and the product of the two diameters; multiply this sum by one-third of the perpendicular height, and by .7854; this last product will be the volume of the frustum. To express this rule in symbols, let v denote the volume, d the diameter of the upper base, D the diameter of the lower base, and h the height of the frustum; we then have:

$$(D^2 + d^2 + D \times d) \tfrac{1}{3} \times h \times .7854 = v. \qquad (b)$$

Now to apply this to the example we shall take the diameter of the lower base to be equal to $d + 1$; hence formula (b) will become:

$$[(d+1)^2 + d^2 + (d+1) \times d] \tfrac{1}{3} \times h \times .7854 = v. \qquad (c)$$

The square of $d + 1 = d^2 + 2d + 1$; hence we have:

$$(d^2 + 2d + 1 + d^2 + d^2 + d) \tfrac{1}{3} \times h \times .7854 = v. \qquad (d)$$

which reduces to

$$(3d^2 + 3d + 1) \tfrac{1}{3} \times h \times .7854 = v;$$

dividing this equation by 3, and transposing, we have:

$$(d^2 + d) = \frac{v}{h \times .7854} - \tfrac{1}{3};$$

bringing the first member of this equation to a perfect square, we have:

$$d^2 + d + \tfrac{1}{4} = \frac{v}{h \times .7854} - \tfrac{1}{3} + \tfrac{1}{4};$$

hence

$$d + \tfrac{1}{2} = \sqrt{\frac{v}{h \times .7854} - \tfrac{1}{3} + \tfrac{1}{4}}$$

therefore

$$d = \sqrt{\frac{v}{h \times .7854} - \tfrac{1}{3} + \tfrac{1}{4}} - \tfrac{1}{2};$$

or using decimals we have

$$d = \sqrt{\frac{v}{h \times .7854} - .083 + .5}$$

as given in formula (a.) Of course to deduce this rule a knowledge of algebra is necessary, and we do not know of a simpler way, unless you are satisfied with a close approximation, which may be obtained as follows: Divide the volume by the height, which gives an area nearly equal to that midway between the bases of the frustum. Thus, $\frac{535}{8} = 66.875$ square feet; the corresponding diameter is nearly 9 feet 3 inches; adding 6 inches to this gives us 9 feet 9 inches for the diameter of the lower base, and 8 feet 9 inches for the diameter of the upper base.

Business Specials.

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Grant Gear Wheels, Gear Cutting, page 20.

Shafting Straighteners. J. H. Wells, Tampa, Fla.

Ideal Drawing Stands. M. C. Hammett, Troy, N.Y.

Forming Lathes, Mer. Mach. Tool Co., Meriden, Ct.

A. D. Pentz, Consulting. Tools. Elizabeth, N. J.

Tool Holder: Armstrong Bros. Tool Co., Chicago.

"Bradley's Power Hammers, the best in the world." 20 sizes. Bradley & Co., Syracuse, N. Y.

Drop Presses, Punches and Shears. Williams, White & Co., Moline, Ill., manufacturers.

Pattern and Brand Letters. A variety of sizes and styles Heber Wells, 8 Spruce St., New York.

Davis Key-Seating Machines kept in stock by Manning, Maxwell & Moore, 111 Liberty St., N. Y.

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt St., N.Y.

S. A. Smith, 23 S. Canal St., Chicago, Ill., is agent for Holbrook's new loaded rawhide mallets.

Automatic Gear Cutters. Best in the market. Superior Machine Works, 106 Canal St., Cleve'd, O.

Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus, air pumps, acid blowers, filter press pumps, etc.

For the Latest Improved Diamond Prospecting Drill, address the M. C. Bullock Mfg. Co., cor. Canal and Washington Sts., Chicago, Ill.

Patterson, Gottfried & Hunter, Limited, 146–150 Centre st., New York, are putting on the market a new alarm speed indicator. Send for circulars.

We have special facilities for the cheap manufacture of medium weight machinery; write us for prices. Kollmyer & Talbot, Keokuk, Ia.

S. W. Card & Co., Mansfield, Mass., are putting on the market a new line of stocks and dies, with their patent adjustable dies and guide. S. A. Smith, 23 S. Canal Street, Chicago, Ill., Western Agent.

25" } "Only Drill Press built on
32" } 'Ko-rekt' principles,
37" } Even if they come from Jersey."
42" } Gould & Eberhardt, New Ark, N. J.

Patent Soliciting of High Class.
D. Walter Brown, Counsel in Patent Cases,
31 Nassau Street, New York.
Send for Brief History of Patent Legislation.

"Modern Machine Shop Practice," by Joshua Rose wanted for cash, or in exchange for other mechanical or electrical books; send for our cat. N. W. Henley & Co., 150 Nassau St., N. Y.

De Lamater Screw Propeller Wheel, made only by The Samuel L. Moore & Sons Co., Elizabethport, N. J., who have purchased from C. H. De Lamater & Co., New York, all their patterns, books of record, gauges, etc. Location and equipment well adapted for Heavy Steamship Repairs.

"Binders" for the AMERICAN MACHINIST. Two styles—the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers with full page opening flat. Either will hold the entire 52 issues of any volume. AMERICAN MACHINIST PUBLISHING CO., 203 Broadway, New York.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator and making all required calculations from the diagram, also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price, $2 postpaid. Published by John Wiley & Sons, 53 East Tenth Street, New York.

An Old Machine.

BY W. H. BOOTH.

We are apt to conclude that the progress of mechanical arts has been gradually but onwardly progressive from ancient to modern times, but a little reflection seems to contradict this.

When Johnson wrote his celebrated dictionary, which was published about 1754, he did not always trouble himself to give to a word its correct etymological definition, and to a considerable extent we can glean from its pages some idea of the manners, customs and opinions of the time. For example, "excise" is defined as a "hateful tax upon commodities," a definition true enough, no doubt, as regards the opinions held of the tax (especially in Boston), but scarcely sufficient or what we should now expect from a lexicographer.

Similarly, and what is more to the point with us, Johnson defines "Mechanick" as "a low, mean fellow," and this undoubtedly does express the current opinion of the time. Mechanics were looked down upon most

thoroughly, and in this Johnsonian definition we appear to get a glimpse of the very low estate to which the mechanical arts had fallen in this country between the time of the great Newton and the improvement of the steam engine by Watt. This neglect of useful arts seems to be the characteristic of the whole Georgian period, which does not contrast well with previous ages, when, even under the Stuarts, we find the art of dialing much studied and logarithms were invented. I have read somewhere that about the year 1641 the first pendulum clock was made, and in England, too, but more recent knowledge throws a doubt on this. Through the business stoppage of Easter I have been staying away, and I went to the most out-of-the-way place I could think of. True it is only about seventy miles from London and the railroad goes past it, but such a railroad!!! Tell an Englishman it is the Southeastern and he knows at once it is the worst line in the country. Anyhow it took from 12.40 to 4.20 to get there, and this is not bad for the Southeastern Railway. It is all right, however, when you do get there. Three of us had the town of Rye to ourselves. At one time it was a seaport, one of Cinque ports to whom the provision of England's naval defense was intrusted, and the town stands on a rock rising nearly perpendicularly out of the sea; that is it did do, but the sea has retired about two miles away, and now Rye rock stands in the middle of fields, and except from habit there is really no reason but pure inertia why it need continue to exist. It is a curious place, anyhow, and to use the expression of an American friend, looks "blamed old." There was one item in it, however, of great mechanical interest. Right upon the peak of the rock stands the church. This, too, must have become accustomed to its situation, for portions of it have been there from 1199. A steep street leads up to it, and as I climbed up this I could see right into the church through the window over the door, and I saw something about a foot in diameter swinging to and fro about a yard or more, and so I went and investigated, and the object proved to be the bob of an immense pendulum. This belongs to a clock which is placed in the tower, and there is a slot in the ceiling through which is swung the pendulum, and as this latter is eighteen feet in length it comes well through the floor of the clock chamber and swings right down in the church where it can be seen by parson and people, and you can hear the tick all over the building. The clock, I was told, is the oldest going in England, and is said to have been taken from one of the Spanish ships (which in 1588 came this way to make us all into Spaniards, but changed their minds), and Queen Elizabeth is credited with having presented it to the town.

You may get access to the clock tower by finding the clockmaker, near the old Landgate, who has the winding up to do. He will send his boy up with you. The first curious detail is that there is no key to wind up the going weights, but instead there is a hand-wheel about twenty inches in diameter attached to the rope barrel, and this wheel is just pulled round by hand. The same arrangement also obtains with the mechanism which strikes the quarters, but for the hour bell there is a handle to wind up with.

The clock wheels are some of brass and some of iron, and the pinions are of the pin style, consisting of a couple of disks, between which round pins form the teeth—lanterns, I believe they are termed, the teeth being "rungs." (Fig. 1.)

The escapement is almost identical with that of the cheap clocks of to-day, whilst the striking gear is of the notched plate variety, practically the same as used in all clocks to-day which have not the "Snail" motion.

The framing is of bars, light and of skeleton form, but sufficient, and, as a machine, there was little wanting, and it surprised me to find how very small is the advance since the time when this clock was made. If its origin be as stated then it is over 300 years old—has been going, in fact, ever since the State of Virginia was founded by Sir Walter Raleigh and those closely following him, and though there are evidences of wear there is no reason why, with reasonable care, it should not run another period equally as long.

In certain machines the earliest inventor seems to have adopted that plan of construction upon which no improvement has been found possible.

Watt left the steam engine as he found it, except that he added the air-pump and separate condenser, but the cylinder and piston are the same, and have remained so to this day.

Arkwright's spinning frame remained identical for years, and its modern substitute, the ring frame, embodies the same wasteful principle of frictional retardation, and Crompton's mule is still unchanged. The old Rye clock is but another instance of how, for certain ends, there is one successful means to be adopted, for it has practically the arrangements and parts to be seen in the thousands of clocks made daily in Connecticut. Rye lies so much out of the beaten track that I fear it is found by few if any Americans, and not an Englishman in a thousand has ever been there indeed, expect their acquaintance is much closer with the American product of the name.

As I write, the AMERICAN MACHINIST arrives, with Prof. Sweet's communication on

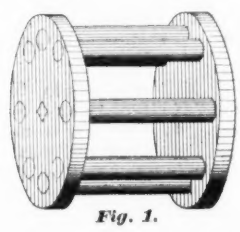


Fig. 1.

boasting. There is an item of which Americans have little to say, and yet which to me appeared to be more than anything a point in which they were entitled to boast. I refer to the elevators for use in large office buildings and also to the buildings themselves.

There is nothing on this side which approaches the large buildings of New York for convenience or arrangements generally. I mean such buildings as 15 Broadway and others similar, containing several elevators and a sufficient number of offices to reduce the elevator cost to a small amount per office.

We have possibly larger buildings—one for example known as the Rabbit Warren, with entrances in several streets and so ever lastingly complicated internally that you can never tell upon which street you will emerge when you have found your way out. I don't know my way about that building yet, and I don't mean to make any special effort to learn it. There are several of the perpetual motion elevators in this building which are like a continuous dredger bucket chain—never stop, but run slow enough to allow you to mount and dismount at any floor, but they are awfully slow.

The Otis Company and some English makers are now putting in quite a number of elevators in the center of the staircase wells of some buildings, but generally this is a deficiency, and yet I never heard an American raise his voice in praise of the superior arrangements on his side, though I have heard him speak eulogistically of such things as baggage checks and express companies, in which I, as an Englishman, take no stock whatever, for I find the English system of baggage arrangements better and cheaper; but I do miss the elevators for office buildings, and think I may say that the space saved by a reduction of staircases and generally by massing many offices together would easily pay for the elevators; nor in this direction can I see anything whatever in climatic differences or otherwise to account for the difference of practice. Possibly it may be a question of ground landlords. So many other differences of practice—the above baggage check for instance, are caused by external influences, as distance, etc., that they are easily explained. I would conclude by saying that Prof. Sweet might almost have made an exception of his engine when he referred to better work being done elsewhere.

As regards giving away catalogues, probably most of those who write on plain paper are the paid servants of business firms, who desire naturally to possess their own books of reference and naturally do not wish the catalogue to be forwarded to the firm, as in many cases it would be probably pitched into the basket almost unopened or would be otherwise appropriated before it filtered through to the drawing office. Four years ago a New York man gave me a catalogue, and I had occasion to use it for the first time recently, with the result, probably, that he will receive an order before long that he may be quite unable to trace to a casual acquaintance so long ago, but he was civil to me, and life is too short to reply to the list of questions some people will write should you send a post card for the catalogue. Doubtless many a good business transaction has commenced by a penciled inquiry on a card purchased from a nickel slot machine, and often good business results from some very funnily spelt inquiries.

Marking Prices at Chicago.

Somebody has undoubtedly blundered in regard to granting to foreign exhibitors at the World's Fair the privilege of marking their exhibits with tags, giving the price of the goods in the country where produced.

At first it was given out that exhibitors would be allowed to so mark their goods, and British manufacturers had been persuaded to prepare exhibits with the distinct understanding that such marking would be allowed. Afterwards it was announced that such marking would not be allowed, but that only the price at which the goods would be sold in Chicago would be permitted to appear.

This would have been well enough, perhaps, if the Fair were to be considered strictly a Chicago show, but for a World's Fair it was so palpably unreasonable and unjust that quite a storm was raised about it among foreign manufacturers preparing to exhibit, with the result that the decision has been again reversed, and exhibitors are now to be allowed to mark their goods with the home prices.

Though the matter is now apparently settled right, the "backing and filling" on the subject will undoubtedly have some bad effect, and it is to be regretted that the first announcement was not adhered to.

We cannot conceive what reasonable objection anyone can possibly have to allowing any manufacturer to mark home prices upon his goods, to which a visitor from any other country can add transportation charges, tariff, if any, and other items, to arrive at the cost of the goods delivered to him.

It seems to us that those who would object to an honest marking of home prices upon exhibited goods take a very narrow view of the situation, and one which, if it prevailed, would do no credit to American enterprise and love of justice or fair play.

Nor can we see that American manufacturers have anything to fear from such marking. We know that in many lines of manufacture American prices—quality of goods considered—will compare very favorably with those of English or other foreign manufacturers, and when our prices are found to be higher there should be some good reason satisfactory to us. It is not to be expected that prices of all goods will be cheaper in any one country than in any other country. We know that there are many American manufacturers who are perfectly willing to compare prices with manufacturers of any other country for the same class and grade of goods. In other lines prices are undoubtedly higher here; that is to be expected, and there can be no advantage in an attempt to conceal the fact, as though it were something discreditable to us.

A correspondent, who desires that his name shall not be divulged, writes us that he must abandon his business in a city not far from New York, because the water supplied for drinking purposes is so impure that he cannot use it for the purpose of his manufacture. There is no way that we know of whereby this manufacturer can better his condition except by moving away from the city he names.

MANUFACTURES

The electric light plant at Austin, Minn., will be enlarged.

Richlands, Va., is talking of the erection of another iron-mill.

A large railroad tool factory will be erected at Mineola, Texas.

A machine shop is to be established by the E. Corbett Co., at Salem, Va.

The Great Northern will build new shops near St. Louis Park, Minneapolis.

George White & Son's machine works at London, Ont., are being enlarged.

A capital of $9,000 has been raised in Dexter, Me., for the new machine shop.

The Blymer Machine Company has been organized at Chicago; capital, $50,000.

S. F. Stephens will establish an iron foundry and machine shop at Greenwood, S. C.

The pump works recently burned at East Superior, Wis., will be rebuilt at once.

The capacity of the Tupelo (Miss.) Foundry and Machine Company will be increased.

The Ohio Bicycle Company has been organized at Cincinnati, O., with a capital of $25,000.

Taft, Burbank & Murdock are erecting a new engine and boiler house at Proctorsville, Vt.

The North Star Iron Works is busy removing its plant from Spring Valley, Minn., to Griffith, Ind.

The Rider Engine Company will employ about 50 new hands in the addition to its plant at Walden, N. Y.

The Mann Edge Tool Company was recently incorporated, at Lewiston, Pa., with $75,000 capital stock.

The Fuel Economizer Company has been incorporated, in Matteawan, N. Y., with a capital of $50,000.

The Graf Iron Melting and Manufacturing Co. has been organized in East St. Louis, Mo.; capital, $30,000.

The Malleable Iron Works plant at West Troy, N. Y., will comprise 11 buildings, to cost about $100,000.

The Interstate Furnace and Machine Company at East St. Louis, Ill., has been capitalized at $100,000.

The Vance Cotton-mills, Salisbury, N. C., has increased its capital $25,000, and will put in new machinery.

New machinery, for the manufacture of finer goods, will be placed in the Knoxville (Tenn.) Woolen-mills.

The Maryland Brass Company, Baltimore, Md., is building an addition to its brass foundry and machine shops.

T. Day & Co. have been organized at San Francisco, Cal., with capital of $200,000, to manufacture electrical fixtures.

The Pierce & Miller Engineering Company, of New York, has been organized, to manufacture machinery and tools.

A new addition is being built at the Central Oil Stove Works at Gardner, Mass., to be used as an engine and boiler room.

It is stated that the Bridgeport Steel Works Company, of Chicago, contemplate the erection of a steel plant at Mobile, Ala.

The Alexandria Foundry and Machine Shop, at Alexandria, La., will be greatly enlarged, and a number of machines put in.

New machinery, for the manufacture of saw and grist-mills, will be placed in the Perkins Machinery Company's plant at Atlanta, Ga.

Warren Bros. are about to establish a factory at Searsmont, Me., for the building of steam launches and the manufacture of bicycles.

It is stated that the works of the United States Rolling Stock Co., at Anniston, Ala., are to be started again in about thirty days.

Owing to increasing business, the Ontario Iron Works Company, of Canandaigua, N. Y., will soon build a large addition to their shops.

The Lehighton Car Spring Company, at Cumberland, Md, will begin the construction of a building at once, and will employ nearly 100 men.

Plans are about completed for the factory of the Jones Vestibule Car Company, at Denver, Col. The main building will be 900 feet in length.

Wooley & Kenyon, of Anderson, Ind., intend to erect a large brass foundry beside their iron foundry, which will employ a large number of men.

The Fales Foundry, on Sixth avenue, Troy, N. Y., which had been closed for some time, has started again in full, employing nearly 100 men.

The Maryland Brass Company, of Baltimore, Md., has purchased additional ground, and will, in the fall, enlarge its brass foundry and machine shops.

Engineers are drawing plans for a private water supply for the Overman Wheel Co., of Chicopee, Mass., the cost of construction to be about $30,000.

The White River Iron and Steel Company at Muncie, Ind., has put its 8-inch mill in operation double turn. A puddle-mill may be added to the plant.

The Cullen & Rhoderick Engineering Company has been incorporated, at Paterson, N. J., with $25,000 capital, to repair electric, horse and other railways.

The American Wrought-iron Casting Company has been incorporated, at Newport, Ky., to manufacture aluminum metal goods. The capital stock is $50,000.

It is stated that a large iron and steel plant will be established at Escanaba, Mich., by the Delta Steel and Iron Manufacturing Company. The capital is $2,000,000.

The Montague & Lea Machine Tool Company, capital $100,000, has been chartered at Moundsville, W. Va., by W. L. Montague and others, of Baltimore, Md.

The Eagle Emery and Corundum Wheel Company, of Chicago, has been formed. Louis Lloyd, August William Johnson and William H. Deitz are the interested persons.

Work has commenced at Carlisle, Pa., on the new frog and switch works. The shops will be 80x100 feet, and will be so planned that the capacity can be doubled at any time.

The Combination Wrench and Tong Company has been chartered at Pensacola, Fla., by W. G. McClintock, W. F. Creary and J. S. Reese, with a capital stock of $5,000.

Wm. Hardy and R. H. Pierson will erect a plant at Birmingham, Ala., for the manufacture of engines and other heavy machinery. The sum of $100,000 will be invested.

The Delta Steel and Iron Manufacturing Co., of Chicago, has been formed, with capital stock of $1,000,000. L. Benjamin, Charles H. Park and E. M. Flint are the incorporators.

The Chattanooga (Tenn.) Car and Foundry Company are preparing to engage extensively in the manufacture of passenger coaches, and are now increasing their capacity for that purpose.

The South Chattanooga (Tenn.) Business Men's Association is endeavoring to secure site for the erection of a power plant, to supply power to small manufacturing industries.

The plant of the Midland Steel Company, at Muncie, Ind., is nearing completion, and it is hoped to start up in a few weeks with 350 men. Most of the machinery now in place came from Pittsburgh.

The New York Electric Equipment Company has been organized in New York, to construct equip and install all kinds of plants for the production of electric currents for light, heat and power. Capital, $20,000.

The contract has been let for building new shops at Meridian, Miss., for the Queen & Crescent system, to replace those burned a few months ago. The new structure will be of brick, about 500 feet long, the cost being $50,000.

Negotiations are now in progress for the removal of the Fort Payne (Ala.) Furnace to Harriman, Tenn. It is stated that the preliminaries will be completed in a week or ten days, and the removal of the plant will be commenced.

C. J. Hubbell, of New York City, representing the Portable Electric Lamp and Power Company, is endeavoring to organize in Chattanooga, Tenn., a stock company, for the manufacture and sale of his concern's electrical specialties.

The Sulzer-Vogt Machine Co., Louisville, Ky., distribute a very fine catalogue relating to elevators. This company makes a large variety of these useful appliances, and their catalogue quite fully illustrates and describes them.

The American Iron Company, at Connellsville, Ind., has made a contract for the erection in that place of a foundry, 40x80 feet, to be used for the manufacture of iron under a new process. Fuel gas under the Harris patent will be used.

The Indiana Iron Company, of Muncie, Ind., have awarded the contracts for the erection of new nut and bolt works. There will be three main buildings, each 254x50 feet, one to be built entirely of iron by the Indiana Bridge Works, and the other two of brick.

On the 14th inst. the Chicago, Rock Island & Pacific let contracts for building new shops at Valley Junction, a suburb of Des Moines, Ia. The contracts call for an expenditure of $250,000, one-half to be expended this year. Minor car and repair shops on the system will be abandoned.

B. F. Mahler, with the Lodge & Davis Machine Tool Co., Cincinnati, O., has issued a very neat pamphlet, representing the consideration due the tool trade. Mr. Mahler is salesman for the company named above, and he has prepared a catalogue of interest to manufacturers and others.

The Westinghouse Machine Co., of Pittsburgh, is building a new brick addition, 50x265 feet, to the assembling and erecting shop. The new building will displace the old erecting shop, which was 30x265 feet. It will be lighted by means of 3,000 square feet of skylight and will be equipped with two 10-ton power cranes.

The Tampa (Fla.) Street Railway and Power Company, a newly organized concern, has purchased the Tampa Electric Company's electric light plant, and will erect an entire new plant. The new company has a capital stock of $1,000,000. J. H. Ahern is president, and J. R. Rutter, of Philadelphia, is vice-president.

The contractors say that the extensive shops of the Norfolk & Western road going up at Lambert's Point, near Norfolk, Va., will be fully completed within five weeks. The machine shops are 80x100 feet, the repair shop 75x380 feet, and the dwellings for the workmen are rapidly going up, and will be occupied as soon as completed.

The M. A. Sweeney Company has been incorporated, at Jeffersonville, Ind., capital, $100,000, to carry on and operate the foundry, machine, architectural and boiler business, and build and construct steamboats and other water crafts, of wood, iron or steel; incorporators, Michael A. Sweeney, James W. Sweeney and Patrick H. Sweeney.

Charles Churchill & Co., Limited, London and Birmingham, England, have issued a very fine catalogue of American machinery and tools sold by them. This is a remarkably enterprising firm, who keep in stock a great variety of machine tools and appliances made in this country, and their catalogue will be of interest to users of such tools.

The Berlin Iron Bridge Company, of East Berlin, Conn., is building a new machine shop for the Solvay Process Company, at Syracuse, N. Y. The building will be 50 feet wide by 300 feet long, and three stories high. The side walls will be of iron and brick (combination construction) with iron floors and iron roof covered with the Berlin Company's patent anti-condensation roofing.

In reply to an inquiry in a recent issue, as follows: "A correspondent is desirous of knowing who makes, for sale, the material fibroid used for making small gears," the Vulcanized Fiber Co., 11 Dey street, New York, sends us its catalogue, which appears to contain the information our correspondent is looking for. This "fiber" is used for a great variety of purposes, many of which are set forth in the catalogue

Machinists' Supplies and Iron.

NEW YORK, July 9, 1892.

Iron—American Pig—We quote Standard Northern brands, No. 1 Foundry, $15 to $15.50; No. 2, $14 to $14.50; Gray Forge, $13 to $14. Southern brands of good quality are obtainable at $14.25 to $15 for No. 1 Foundry; $13.50 to $14 for No. 2; and $12.75 to $13.50 for Gray Forge.

Scotch Pig—Coltness is quoted at $21; and $20.25 for Eglington.

Antimony—The market is easy.

We quote Hallett's, 10¾c. to 11c; Cookson's, 14c. to 14¼c; and L. X., 12½c. to 12⅝c.

Copper—The market is weak. Lake Copper can be had at 11.45c. to 11.50c. Car load lots are quoted at 11.60c. Casting Copper is held at 10¾c. to 11¼c.

Lead—The market is firmer, with sales of 50 tons reported at 4.25c. Car load lots are held at 4.27½c. to 4.30c.

Lard Oil—The market is quoted at 59c. for Prime City. Western on spot is quoted at 58c.

Spelter—It is claimed that the market is firm at 4.80c. to 4.85c., but no business is reported. Bids, 4.75c.

Tin—The market is easy. Spot is quoted at 21.20c. to 21.25c.

✻WANTED✻

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. Seven words make a line, and the address as desired to appear should be included. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Foreman pattern maker wishes to change position; 10 years' exp. Pattern, care AM. MACHINIST.

Wanted—Situation as a first-class tool maker. Address "C," Quarryville, Conn.

A technical graduate, with shop and drawing room exp., wants situation. S., care AM. MACHINIST.

A man of good theoretical attainments and extensive machine shop practice desires situation as foreman. S. W., AMERICAN MACHINIST.

Wanted—Position, by a first-class mechanical draftsman, exp'd in air compressors stationary and marine engines. Box 27, AM. MACHINIST.

Wanted—Machinist (German) with 5 years' shop and 2 years' technical education, good draftsman, desires position. H. M., AMERICAN MACHINIST.

Wanted—A draftsman. One who can draw well in perspective and shade effectively. A 1st-class opening for a good man. A. Mugford, Hartford, Ct.

Wanted—Foreman for foundry employing 20 men, making steam pumps and light castings. Address Foundry Foreman, care AM. MACHINIST.

Wanted—Position as superintendent or machinist foreman, by an energetic man with large and varied experience, both as a practical workman and manager; mean business. "A," AM. MACHINIST.

Wanted—Situation as superintendent or foreman of foundry; 15 years' experience on marine and heavy castings of every description; best of references given. Address Box 25, AM. MACHINIST.

Wanted—Five first class lathe hands, and five floor or vise hands. Wages $2.25 to $2.75 per day; steady work. Sioux City Engine Works, Sioux City, Iowa.

Wanted—First-class man, who has had long experience in Corliss engine building; must be first-class draftsman and inspector, and able to figure on compound condensing plants. Address, giving exp., ref., and salary desired, Box 28, AM. MACH.

Wanted—Situation as foreman in boiler shop, by one who has had 25 years' experience as proprietor and foreman; for last 12 years have made chemical pulp boilers a specialty; first-class references. Address Box 30, AMERICAN MACHINIST.

Wanted—A foreman for our hardware dep't, who has had a gen'l exp. in the mfr. of builders' hardware, or similar business; he must be a 1st-class man in every respect, and competent to manage men; write, stating particulars; correspondence confidential. Van Wagoner & Williams Co., Cleveland, O.

Wanted—At Sibley College, Cornell University, Ithaca, N. Y., several good workmen as instructors in the various shops; should be about 30, studious, skillful, interested in their work, and appreciative of the opportunities offered in residence at a great university; pay moderate, but positions otherwise attractive to the right men. Address the Director.

Wanted—A situation as superintendent; have had 4 years' experience on typewriter, first as foreman, and later as superintendent; previous experience has been on sewing machine, machine tools and watch tools; or would design and construct a typewriter or other light machinery for the market; age, 38; reference. Address Box 29, AMERICAN MACHINIST.

Wanted—A first-class experienced jig and special tool maker; one thoroughly acquainted with Corliss engine work, who has had experience in getting up jigs, and special devices for insuring uniformity and accuracy in the work, and reducing the cost; a good job for a strictly first-class man; none other need apply. Send references, age, and experience in the work, with wages expected, Sioux City Engine Works, Sioux City, Ia.

Wanted—A situation, by a thoroughly practical machinist and draftsman, 35 years of age; experienced in the design and construction of compound, marine and stationary engines, and mill machinery, well up on valve motion, and the use of the indicator; familiar with modern work and methods, possessed of good mechanical judgment, and accustomed to handling men; would not object to traveling part of the time. Address Y. Z., care AMERICAN MACHINIST.

Wanted—A young mechanical draftsman, who has had shop experience, and who is qualified to write about mechanics; a young man from 25 to 28 years of age preferred. Address E, Room 18, Coal Exchange, Scranton, Pa.

✢ MISCELLANEOUS WANTS ✢

Advertisements will be inserted under this head at 35 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Wall Drills complete, $25. S. M. York, Clev'd, O.

Best Steel Flue Scrapers. Kelley Co., Erie, Pa.

Cheap 2d-hd lathes & planers. S. M. York, Clev'd, O.

Presses, Wire Form'g Mchy. Am. Tool Wks, Clev, O.

PURE FEED-WATER For Steam Boilers.

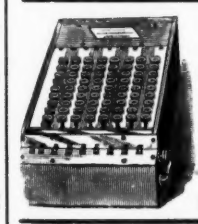
THE BUNNELL FILTER AND PROCESS Furnishes Steam Boilers with water that is absolutely freed from all scale producing substances. Guaranteed or no sale.

BRADLEY & COMPANY, SYRACUSE, N. Y.

STEEL TUBES WELDLESS SMOOTH · COLD DRAWN John S. Leng's Son & Co. New York.

ENGINE RUNNERS' CATECHISM. (A Sequel to Steam Engine Catechism.) By ROBT. GRIMSHAW, M. E. *18mo, Cloth, $2.00.* JOHN WILEY & SONS, NEW YORK.

Experimental Work of every Description, Mechanical and Electrical. Contractors for the manufacture of specialties, or can furnish complete plants for their manufacture. Make Dies, Special Tools, Gauges, Drawings, Patterns, Models. Inventions perfected. Estimates furnished. Correspondence solicited. Send for Circular of our SENSITIVE KNEE DRILL. BRADY M'F'G. CO. 83 Washington St., BROOKLYN, N. Y.



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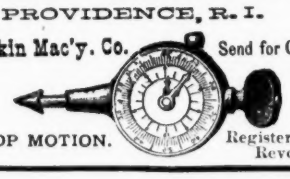
MACHINERY For Reducing and Pointing Wire. ESPECIALLY ADAPTED TO POINTING WIRE RODS AND WIRE FOR DRAWING. For Machines or Information address the Manufacturer, S. W. GOODYEAR, Waterbury, Ct.

TOOLS FOR QUICK DELIVERY. Radial Drills 52 in. and 80 in. Engine Lathes 16 in. by 6 ft., 18 in. by 6 ft. 20 in. by 8 ft. 21 in. by 10 ft. and 12 ft. Pulley Lathes 26 in. 36 in. 60 in. Ohio Machine Tool Wks., Cin., O. WM. LODGE, President.

AMERICAN AND FOREIGN PATENTS. We refer to well-known men and establishments in the machine trades for whom we have done business. Epitome of the World's Patent Laws and Statistics Sent Free on Application. (Registered English Patent Agent, according to Act of Parliament.) F. W. BARKER'S PATENT AGENCY, THE BENNETT BUILDING, 93-99 NASSAU ST., N. Y. Monument Chambers, King William St., London, E. C., England.

THE STANDARD REVOLUTIONS COUNTER, PROVIDENCE, R. I. A. B. Pitkin Mac'y. Co. Send for Circular.



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FRISBIE FRICTION PULLEYS AND CLUTCHES. THE D. FRISBIE CO., 114 LIBERTY STREET, - NEW YORK.

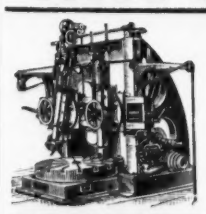
Bowsher's BALANCING WAY. FOR BENCH AND FLOOR USE. 3 SIZES AND STYLES. A new idea. A time saver. A tool to take the place of the devices in present use for balancing pulleys, armatures, cutter heads and rotary parts of machinery in general. Ways are *chilled* and *ground*. Substantial, accurate, cheap. Send for circular. N. P. BOWSHER, South Bend, Ind.

BRASS-WORKING TOOLS. SPECIAL MACHINERY, PRICES on APPLICATION

BARDONS & OLIVER Cleveland, Ohio.

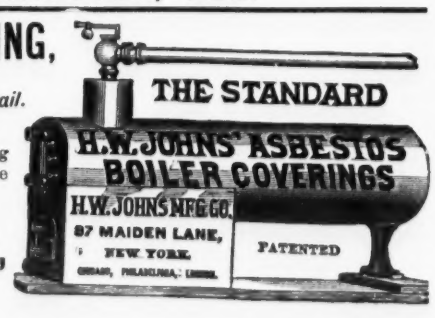
SCREW MACHINES.

VANDERBEEK'S NEW COUNTERSHAFTS. NEW CONSTRUCTION, NEW FRICTION AND SELF-OILING THROUGHOUT. THE STATES MACHINE CO., HARTFORD, CONN.



BORING AND TURNING MILLS. COMBINING EVERY IMPROVEMENT. 14 SIZES FROM 5 TO 20 FEET. BETTS MACHINE COMPANY, WILMINGTON, DEL.

ASBESTOS CEMENT FELTING, FOR LAGGING LOCOMOTIVE BOILERS. *Samples and Descriptive Price List Free by Mail.* We are prepared to take Contracts for applying Steam Pipe and Boiler Coverings in any part of the United States. H. W. JOHNS MANUFACTURING CO., 87 Maiden Lane, NEW YORK.



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Best Bolt Header in the world for $50. Address C. H. Baush & Sons, Holyoke, Mass.

Engines, special and gen. mach'y designed; ideas developed. A. W. Jacobi, 136 Liberty St., N. Y.

Special machinery designed and built. C. F. Langston & Co., 70 N. 4th St., Philadelphia.

Light and fine machinery to order; Foot Lathe Catalogue for stamp. E. O. Chase, Newark, N. J.

Stolpe's Universal Punch is new and the best: write for circular. Stolpe, 154 W. 27th St., N. Y.

Design & superintendence of mach'y. Drawings, etc., made. Claud Mantle, 598 E. 134th St., N. Y.

George D. Slade, dealer in molding sand of all grades, Waterford, N. Y.

Wanted—A specialty to manufacture either heavy or light work. We have splendid facilities. Address "Manufacturers," Rockford, Ill.

Wanted—Hardware specialties to build. Send 25 cents for "Eureka Knife and Shears Sharpener." W. A. Smith & Co., 227 Eddy Street, Providence, R. I.

For Sale—A new 10-ton Aveling & Porter Steam Road Roller; been used but two months. James F. Leahy, 59 John street, Utica, N. Y.

Bound volumes for 1891. We are now prepared to take orders. Price, $4.00 per volume; express charges payable by purchaser. Address AMERICAN MACHINIST, 203 Broadway, New York.

I have several valuable improvements thoroughly tested in the metal line, embodied in two U. S. patents for sale for cash or on royalty. Address BOX 23, AMER. MACHINIST.

We will pay 25 cents each for copies of the AMERICAN MACHINIST of December 25, 1886, issue; must be unsoiled and in good condition. AMERICAN MACHINIST PUBLISHING COMPANY, 203 Broadway, New York.

Machine Tools in Stock.

ENGINE LATHES.

82 in. swing, 34 ft. bed.				Whittier
78	do	9 ft. between centers		Sellers
38	do	17 ft. bed.	New	Fifield
30	do	14	do	do
27	do	16	do	do
24	do	12	do	Fifield
24	do	12	do	Fitchburg
24	do	12	do	Flather
22	do	10	do New Pattern	Fifield
22	do	12	do	do
22	do	12	do New	Blaisdell
22	do	8	do	Flather
22	do	10	do	do
20	do	8	do	do
20	do	10	do	do
20	do	8	do	do
18	do	10	do	do
18	do	8	do	Blaisdell
18	do	16	do	do
16	do	6	do	Flather
16	do	6	do	Blaisdell
15	do	6	do	Flather
14	do	6	do	do
14	do	6	do	Blaisdell
12	do	6	do	do

PLANERS.

42 in. wide, 42 in. high, 12 ft. long, 2 heads				Gleason
36	do	36	do 8 do	Pease
30	do	30	do 8 do	do
30	do	30	do 8 do	Whitcomb
30	do	30	do 8 do	Flather
26	do	26	do 6 do	do
24	do	24	do 6 do	do
24	do	24	do 6 do	Whitcomb
22	do	22	do 5 do	do
22	do	22	do 6 do	Flather

SHAPERS.

12, 16, 20 and 24 inch stroke	Eberhardt
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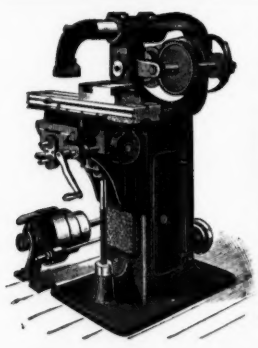

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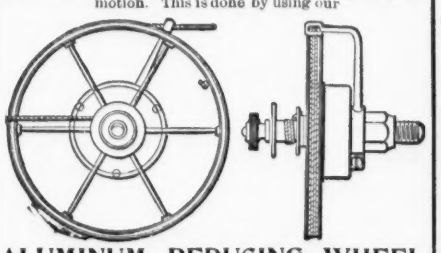

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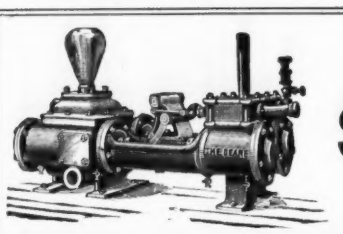

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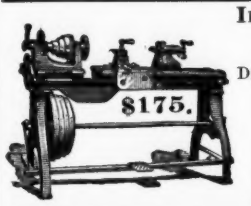

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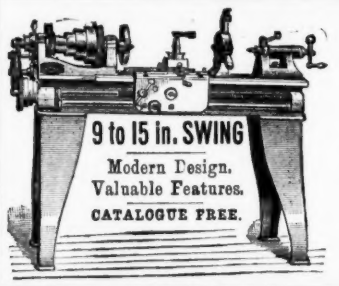

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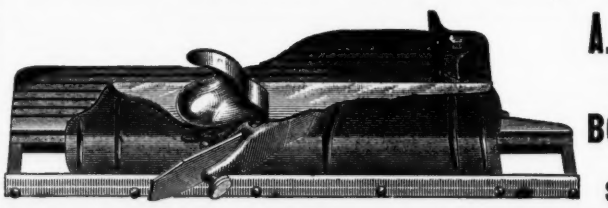

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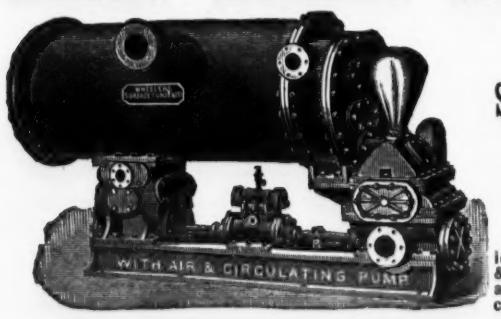

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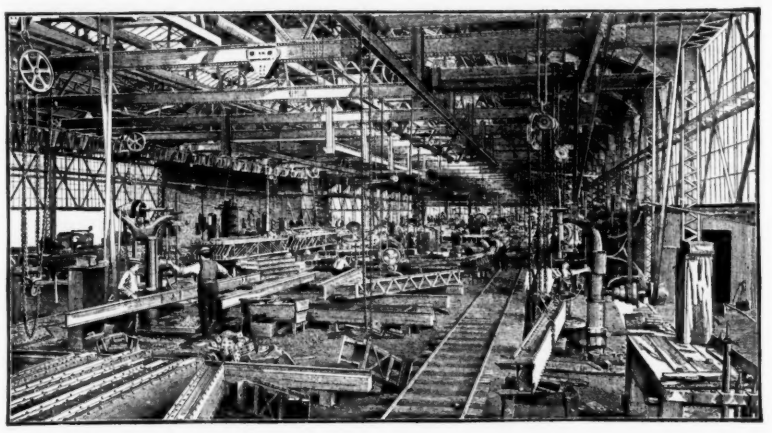

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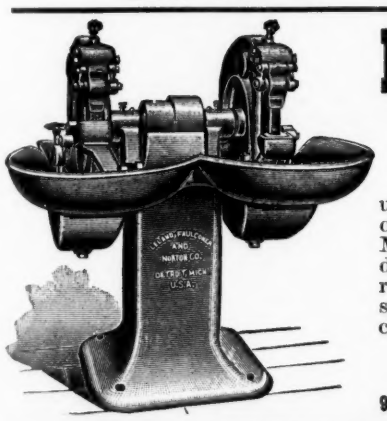

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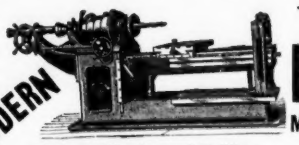

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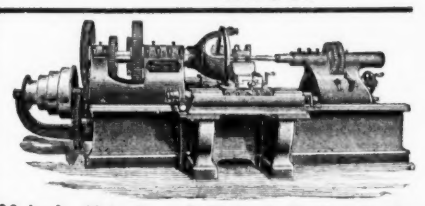

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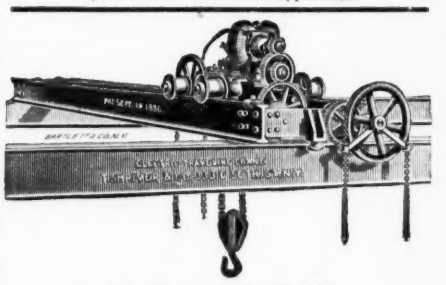

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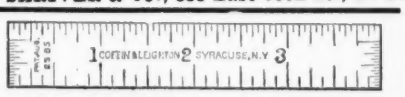

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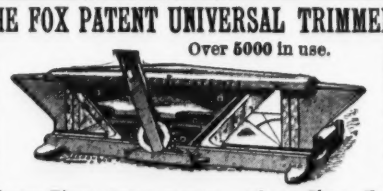

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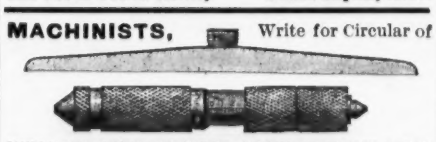

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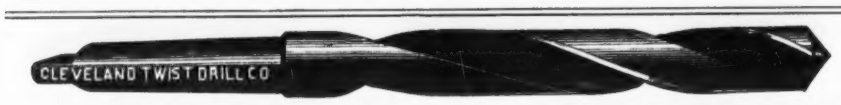

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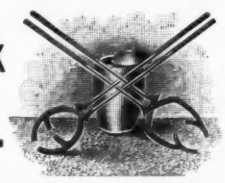

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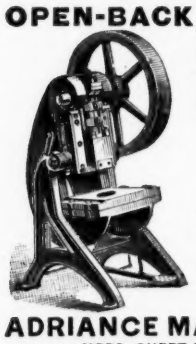

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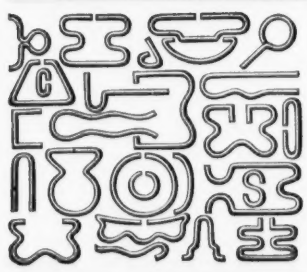

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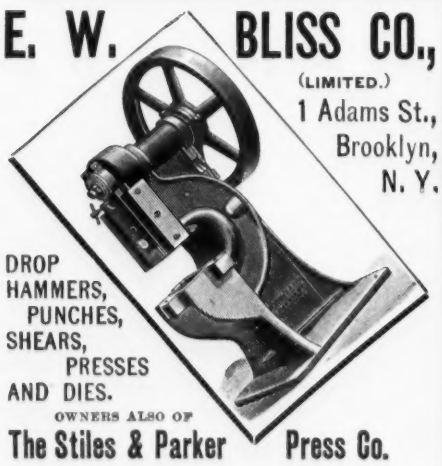

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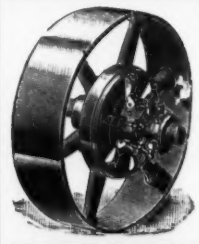

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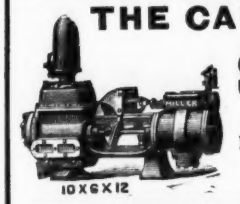
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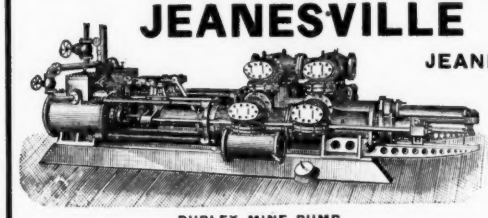
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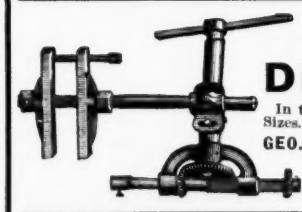

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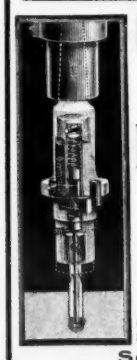

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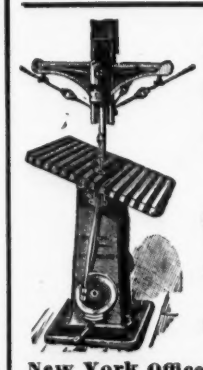

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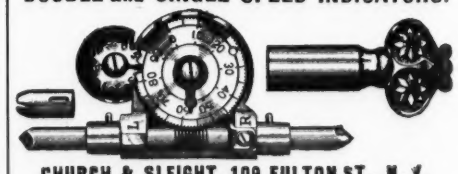

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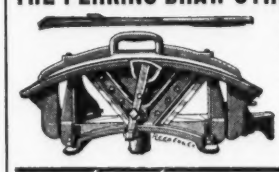

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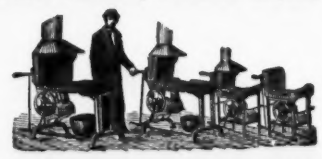

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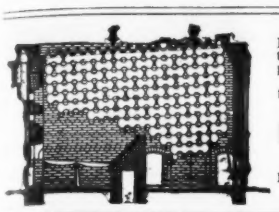

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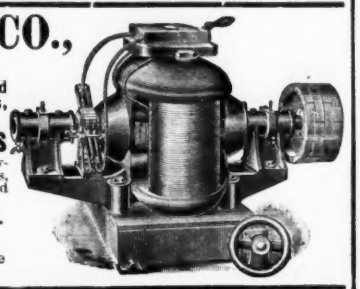

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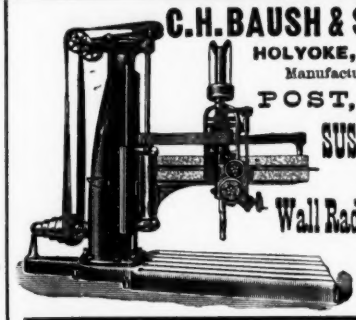

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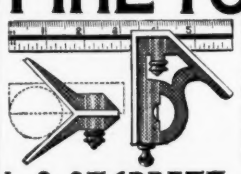

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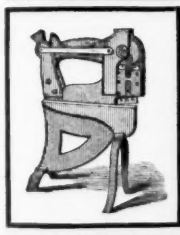

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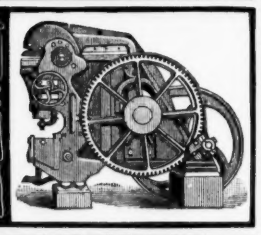

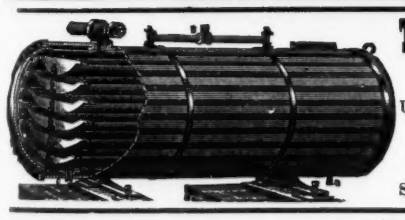

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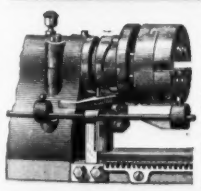

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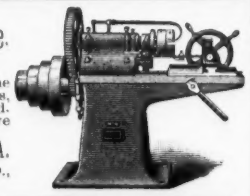

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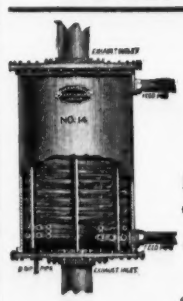

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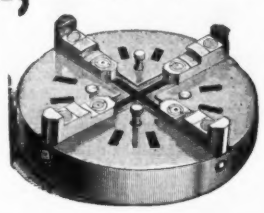

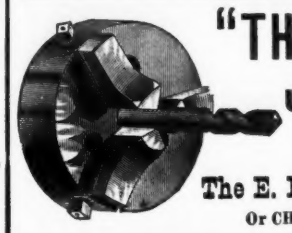

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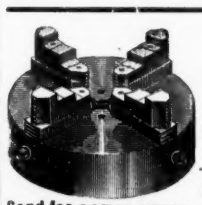

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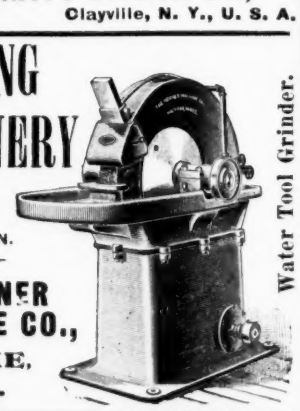

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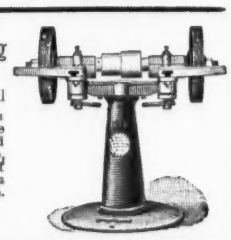

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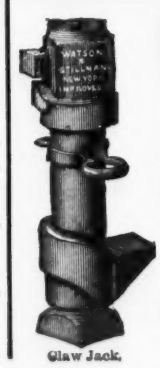

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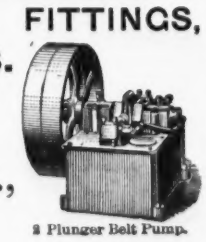

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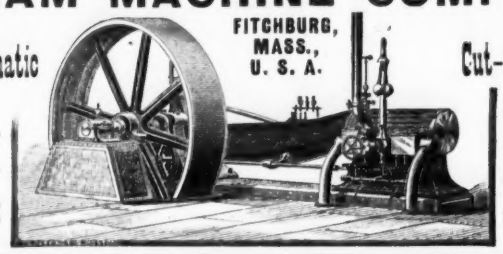

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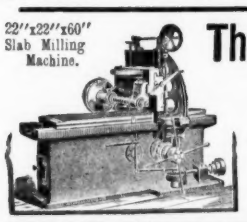

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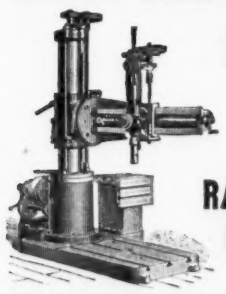

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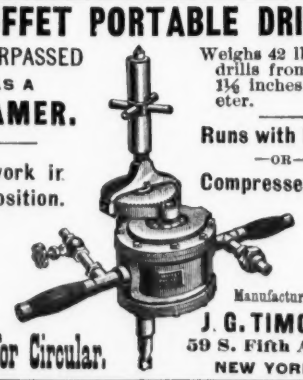

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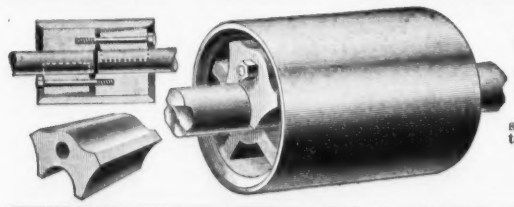

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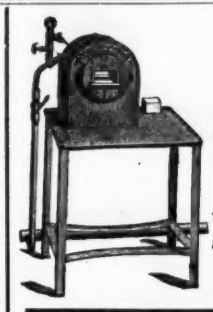

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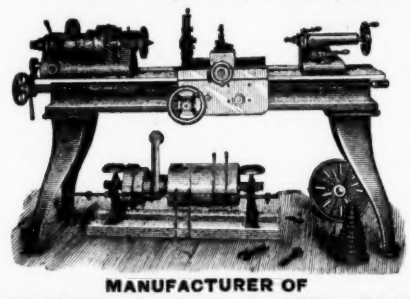

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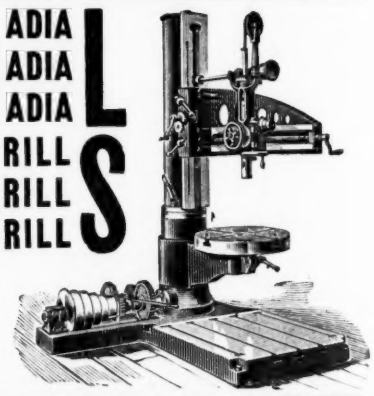

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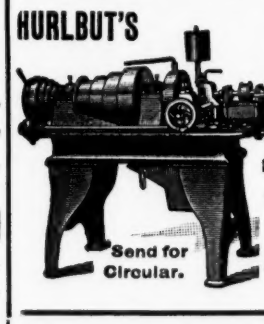

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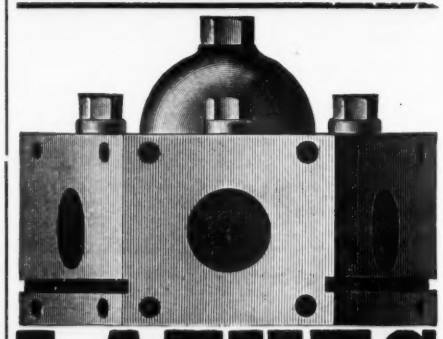

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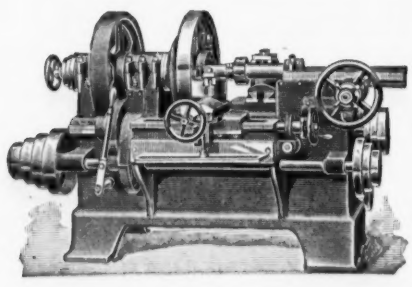

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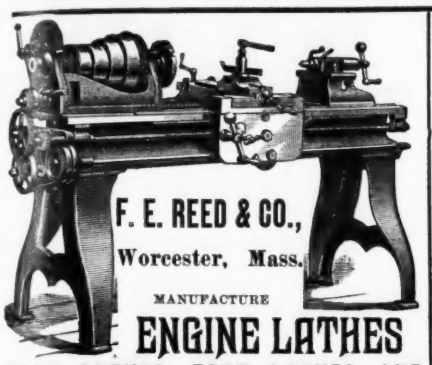

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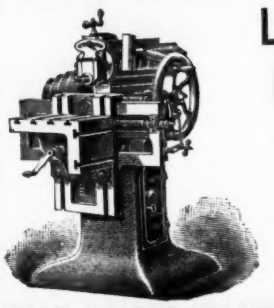

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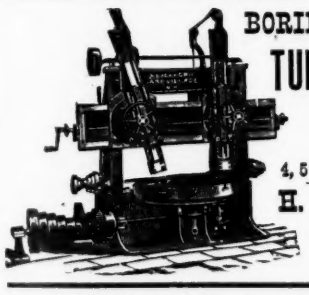

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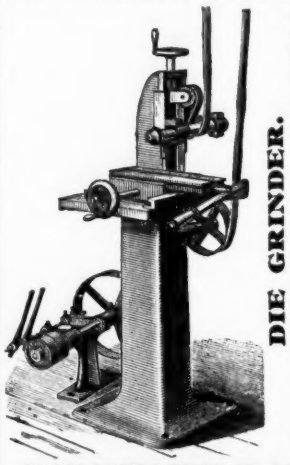

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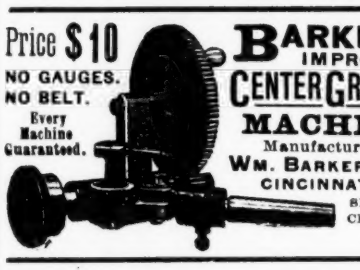

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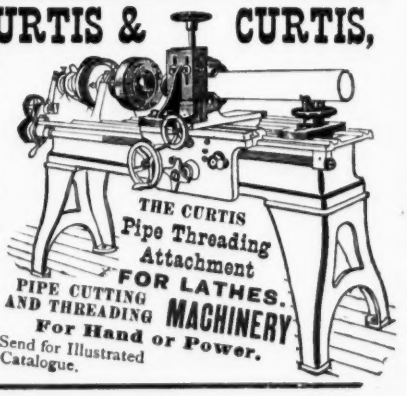

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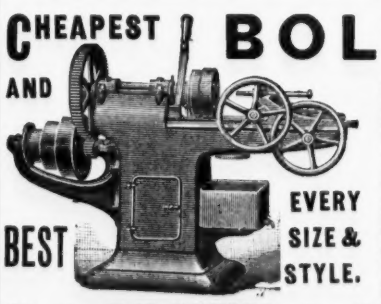

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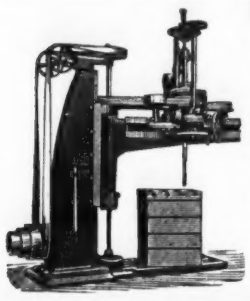

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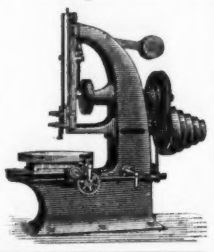

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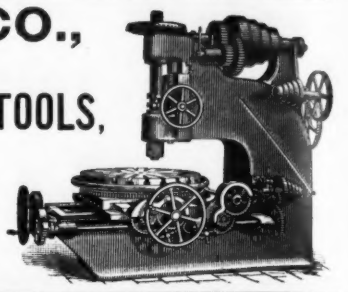

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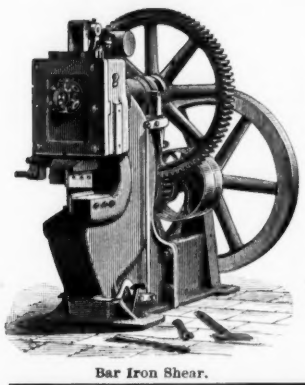

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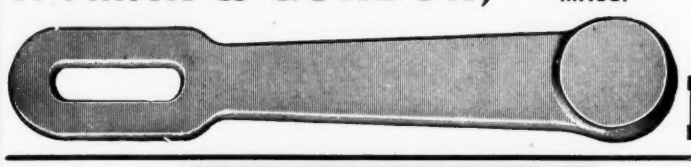

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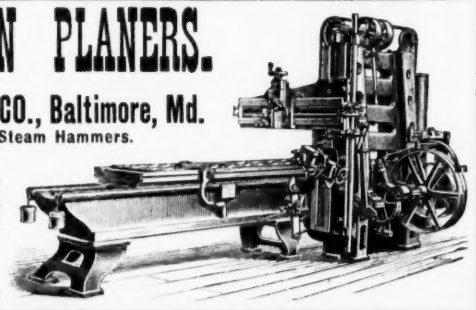

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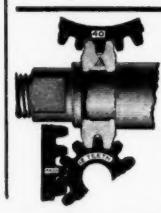

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One pair cuts a pitch from 12 to a rack, inclusive. Of variable shape and interchangeable. These cutters are kept in stock and orders filed promptly. Special cutters and sizes made to order promptly. For descriptive circular, prices and discounts, address
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ACME MACHINERY CO.
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Manufacturers of
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Cutting from 1-8 in. to 6 in. diameter.
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Complete Outfits for Bolt and Car Shops.
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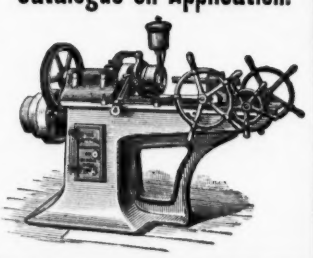

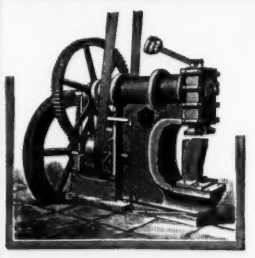

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MANUFACTURED BY
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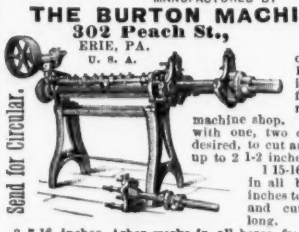

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The cut represents our Stationary and Portable Key-Seating Machine which fully meets all the requirements of a machine shop. They are furnished with one, two or three Arbors, as desired, to cut any width of key-seat up to 2 1-2 inches wide.
1 15-16 inches Arbor works in all bores from 1 15-16 inches to 3 inches diameter, and cuts seats 12 inches long.
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With an attachment for the purpose seats can be cut in holes as small as 1 inch diameter, by one passage of the cutter.
If the work is heavy and too large to be placed on machine it can be detached from stand and used as portable machine.

The Morton Key-Seating Machine
THE LEADER.
With recent patented improvements, we guarantee to do the following class of work.
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Will cut through 4-foot hub, through 5-inch hole. Our new centering chuck and setting attachment the work can be set exactly, without the use of a scale or rule. Our new binding attachment takes the place of bolts, with a key-way and key to fit it.
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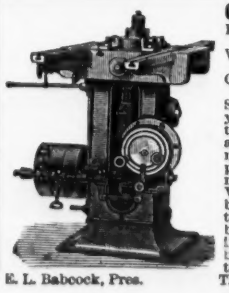

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Key-Making Machines
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Gentlemen: The large KEY SEATER which we bought of you has now been in operation for a number of months, and we have been using it almost constantly since it was purchased, and we are very much pleased with it indeed. We also have a machine made by another firm, which we thought was a good machine but now that we have both in our factory, and use them both, we like yours very much the best.
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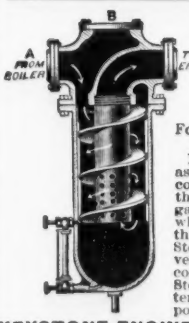

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Place Separator as close to engine as possible, the steam taking a spiral course between the threads causes the water to be thrown by centrifugal force against the outer walls, while the dry steam goes through the small holes to center of pipe. Steam can enter at A or B, as convenience may require; also used in conveying steam long distances, for Steam Hammers, Dry Houses, Water Gas Generators, and for all purposes where Dry Steam is necessary.
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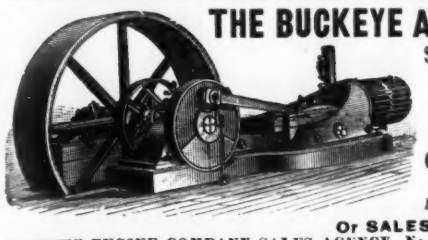

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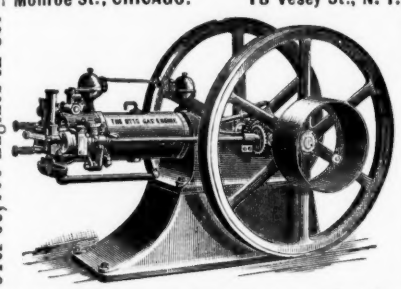

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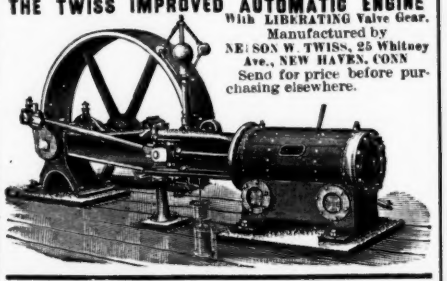

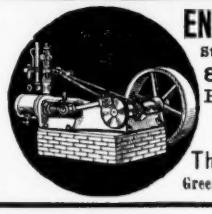

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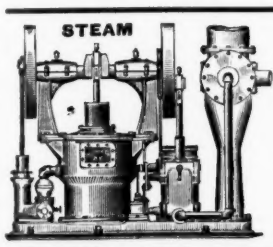

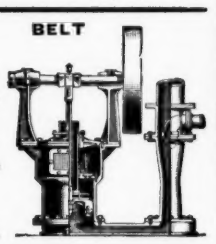

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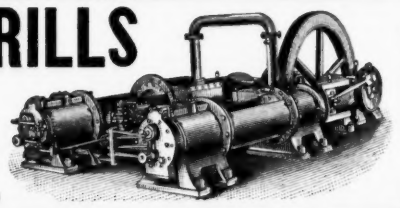

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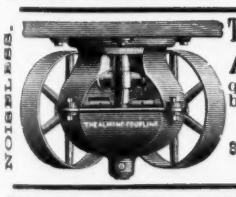

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"	42 in.x42 in.x8 ft., Powell Planer Co.'s, latest pat.	At.
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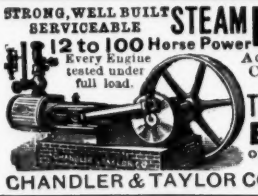
Every Engine tested under full load.



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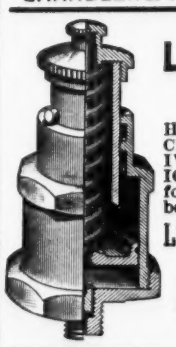

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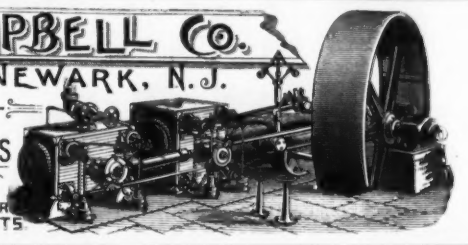

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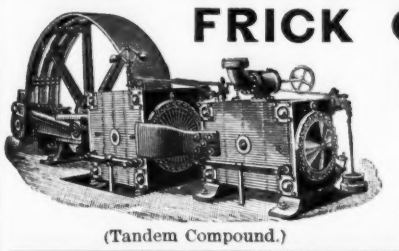

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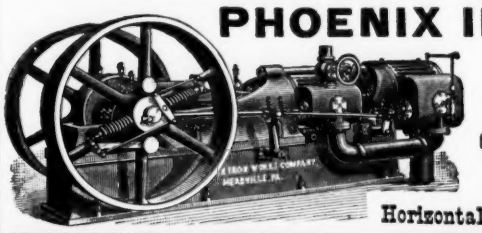

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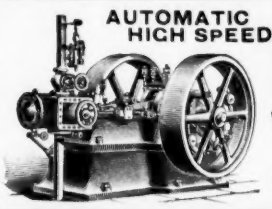

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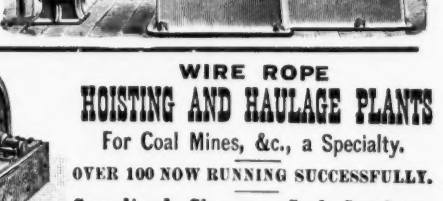

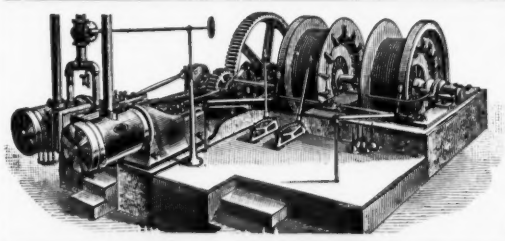

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FROM 1-4 TO 15,000 LBS. WEIGHT.
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THE IMPROVED BALL ENGINE.
AS BUILT BY
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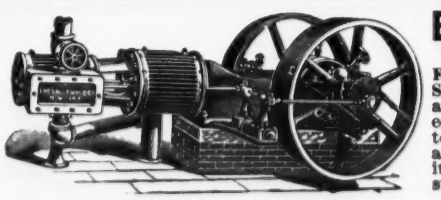

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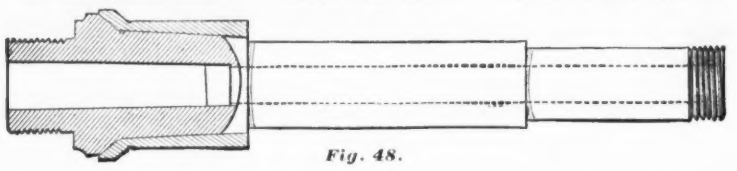
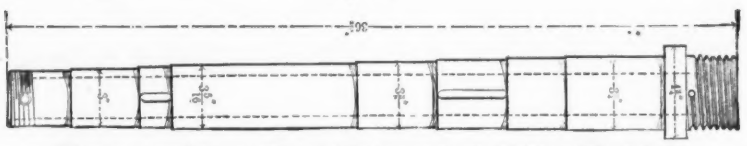


Fig. 48.



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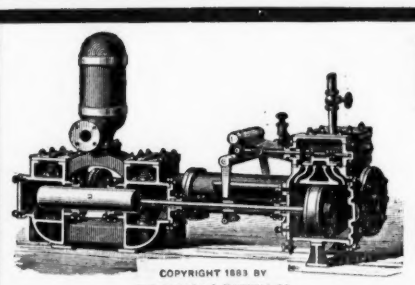

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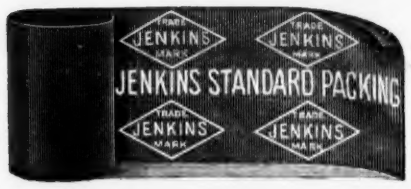

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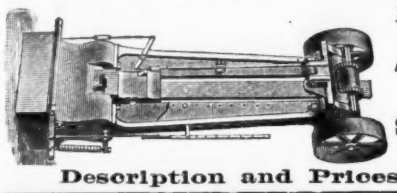

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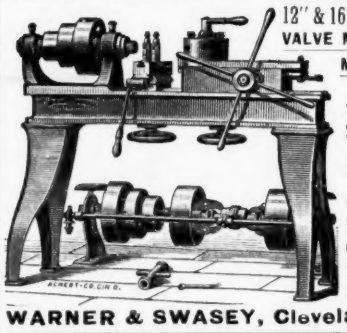
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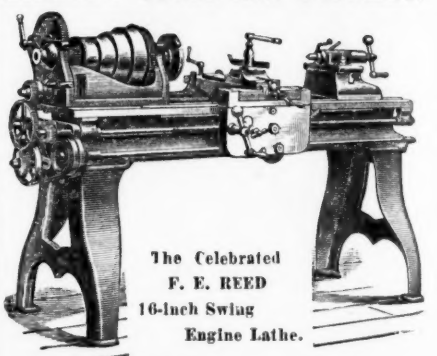

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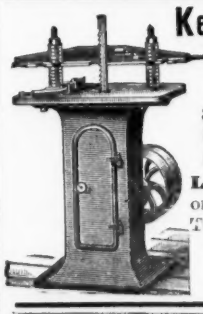

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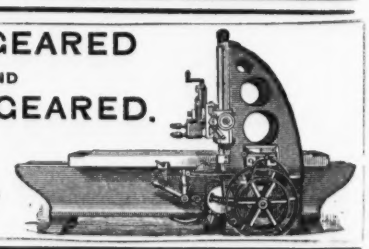

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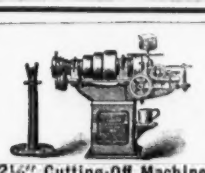

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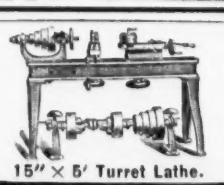

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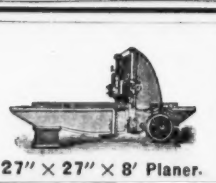

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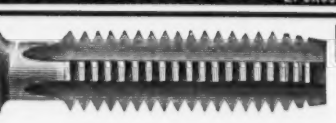

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